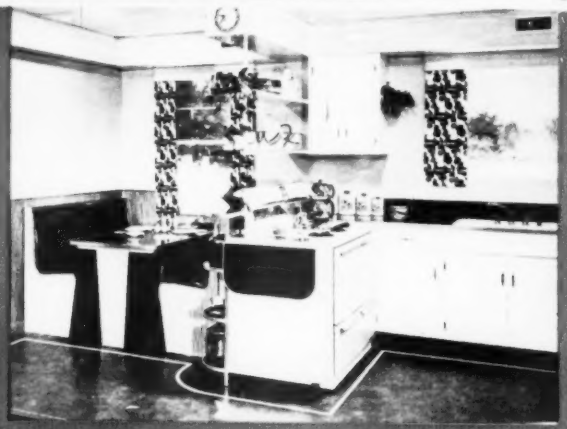
MARCH 1953
PRICE 35 CENTS

ELECTRICAL CONSTRUCTION AND MAINTENANCE

WITH ELECTRICAL CONTRACTING



RESIDENTIAL ELECTRICAL SYSTEMS

A special editorial feature section on electrical design for modern living keyed to current trends in utilization, control and protection . . . complete in this issue.

A McGRAW-HILL PUBLICATION | 52ND YEAR

MAKE THIS ONE-MINUTE CHECK ON YOUR PLANT VOLTAGE

Type of Equipment	Effect of undervoltage	Effect of overvoltage
Incandescent Lamp Bulbs	10% undervoltage cuts light output 30%—slows production.	10% overvoltage cuts lamp life 70%—triples replacements.
A-C Motors	Causes overheating—increases maintenance costs.	Decreases power factor—increases power costs.
Resistance Heaters	10% undervoltage cuts heat output 19%—slows production.	Causes severe overheating—high replacement costs.
Electronic Devices	Drastically cuts tube life. May destroy gas-filled tubes.	5% overvoltage cuts tube life 50%—high replacement costs.
Infrared Processes	Lengthens process time—slows production.	Causes blistering or scorching—increases manufacturing costs.

This chart shows how poor voltage drags your plant efficiency down

Keep your production up by keeping the right voltage with G-E Inductrols

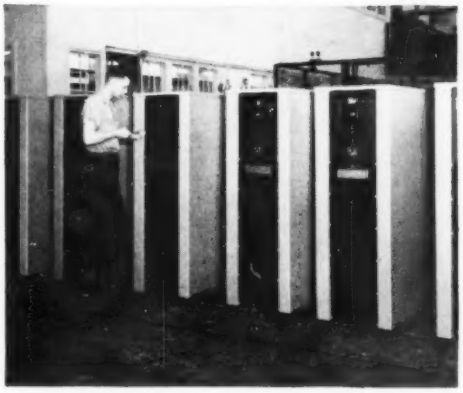
A quick look at this chart tells you why it pays to operate your equipment at correct voltage.

When voltage sags, the efficiency and output of your equipment drop sharply—maintenance costs go up. When voltage rises above the correct value, it shortens the life of your equipment—increases manufacturing and replacement costs.

You can eliminate the problems of undervoltage and overvoltage by installing G-E Inductrols. These new dry-type regulators *automatically* maintain correct voltage for your a-c electric equipment and assure peak operating efficiency.

They can be installed almost anywhere. They're housed in attractively styled, all-steel cabinets that protect plant personnel by completely enclosing all live parts.

For additional information on G-E Inductrols, contact your local G-E Sales representative or authorized agent. Or write for bulletins GEA-5824, GEC-795, and GET-2351. General Electric Company, Schenectady 5, New York. 404-96



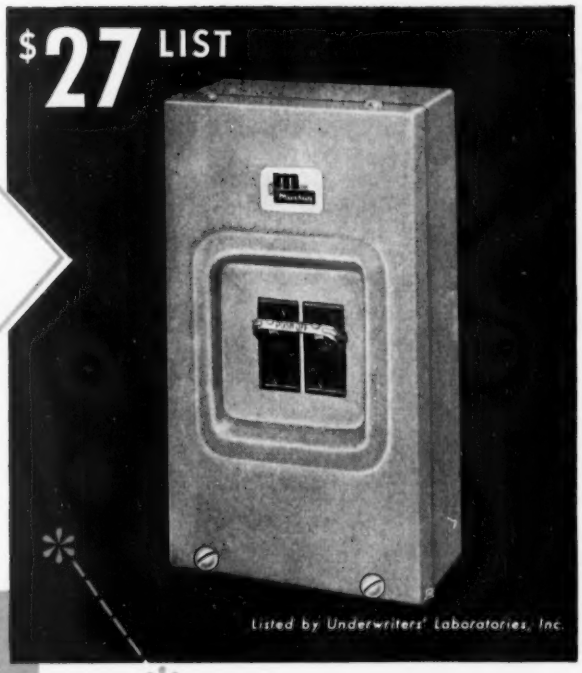
WIDE RANGE of G-E Inductrols covers both manual and automatic operation, single- and three-phase applications. Standard automatic regulators include ratings from 3 kva, 120 volts to 500 kva, 600 volts. Here workman prepares single-phase units for final test prior to shipment.

G-E Inductrols are ideal for light-dimming applications

GENERAL ELECTRIC

100 AMP. CIRCUIT BREAKER PROTECTION AT FUSE BOX PRICES

Another new Murray product



that gives you

Fully Magnetic! protection

LOW PRICE!

In the Murray 100 Amp. Service Control you get circuit breaker protection priced as low as comparable fused equipment.

MANY ADVANTAGES!

1. **Fully magnetic circuit protection.**
2. **Carries full load regardless of temperature.**
3. **Plenty of room for easy wiring.**
4. **Compact (12-1/16 x 6-13/16 x 3-7/8—Indoor, surface type).**
5. **Easy to gang (No side handles).**
6. **Flush or surface mounting.**

WHAT IS IT?

Service control equipment—3 wire, single phase, 120-240 Volts AC. Available in two types: 1—Indoor (surface or flush) or 2—Outdoor (raintight). Supplied with handle extensions for simultaneous manual tripping of two single pole independent trip fully magnetic circuit breakers in 70, 90, or 100 amps.

HOW IS IT USED?

1. Same application as a 100 amp. 3 wire fused switch with neutral or a 100 amp. 2 wire fused switch without neutral.
2. As Service Entrance Equipment.
3. As a main disconnect.
4. For protecting single phase lighting and appliance circuits or for fractional horse-power motor circuits.

IS IT AVAILABLE?

Yes! Call your distributor or contact your nearest Murray representative. Catalog numbers: Indoor—LV2IIA (Add S or F to indicate surface or flush mounting). Outdoor—LR2IIC (At slightly higher list price).

Murray®

FOR DETAILED INFORMATION, WRITE:

MURRAY MANUFACTURING CORPORATION

1250 Atlantic Avenue • Brooklyn 16, New York

Service Entrance & Meter Equipment · Magnetic Circuit Breakers · Switches
Current Limiting Reactors · Crows'nest Aerial Ladders

YOURS—Built-In
MAXIMUM SAFETY
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Interior of ZEPHYR Parlor-Dome Observation Car.

and—**MAXIMUM SAFETY Everywhere with**

APPLETON COUPLINGS

For Use with THIN-WALL Electric Tubing

- Grip like a vise
- Speedy in fitting
- Concrete-tight
- U-L approved
- Rain-tight

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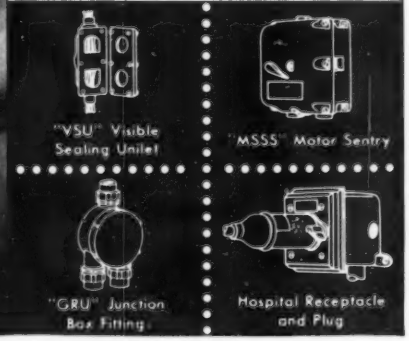
There Are APPLETON Explosion-Proof Fittings for Every Requirement



ELECTRICAL CONSTRUCTION AND MAINTENANCE

Published for electrical contractors, industrial electricians, engineers, consultants, inspectors and motor shops. Covering engineering, installation repair, maintenance and management, in the field of electrical construction and maintenance.

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GENERAL-PURPOSE CONTROL

Fhp motor starter

1—7½ hp manual motor starters

A-c magnetic motor starter

Combination motor starter

Reversing motor starter

Meet Any Motor-Starting Application With A Dependable G-E Magnetic Starter

Thousands of Forms Available

No matter what your requirements, you can get a G-E starter to fit your application. Hundreds of variations of across-the-line, combination, reversing and multi-speed starters are available for a-c motors.

Every form pictured above has the same basic contactor that has proved its superiority again and again in severe industrial applications. You can choose from literally thousands of combinations of the contactor, shown at the right, and its accessory components, to get the best control for your particular motor application.

EXTRA INTERLOCK CONTACTS—as many as four on sizes 0 and 1, three on sizes 2 and 3—can be added to the standard starter for your application.

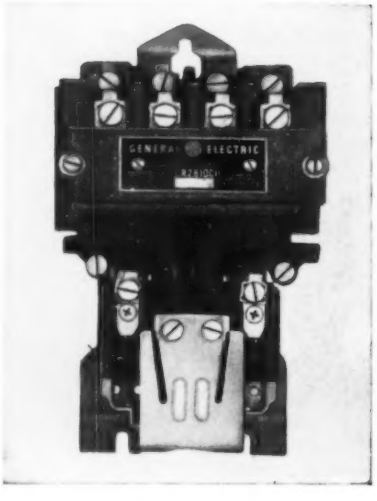
CONTROL TRANSFORMERS for operator protection, extra overload relay for motor protection, and control relays are available as standard components.

EITHER START-STOP push buttons or Hand-Off-Auto selector switches can be mounted in the starter cover.

ENCLOSURES for every motor application include general purpose, watertight, dusttight, semidust-tight, and explosion-proof. Enclosures that meet JIC specifications are also available.

ALL STARTERS have plenty of wiring space. Contacts, coils and overload relays can be removed quickly, conveniently.

Contact your nearest G-E apparatus sales office or authorized agent or distributor for your starters. Write for Bulletin GEC-880 for more details.



INFORMATION FOR CONTRACTORS-PLANT ELECTRICIANS

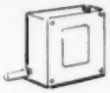
Reduced voltage starter

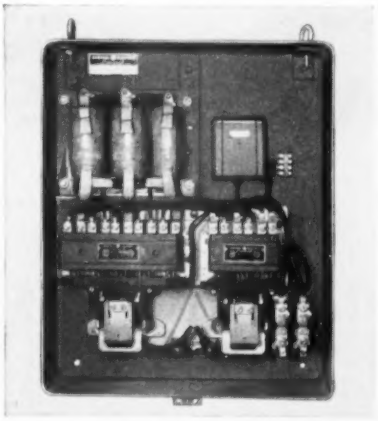
Heavy and standard-duty push-button stations

General-purpose relay

A-c and d-c solenoids

Roller-lever type limit switch

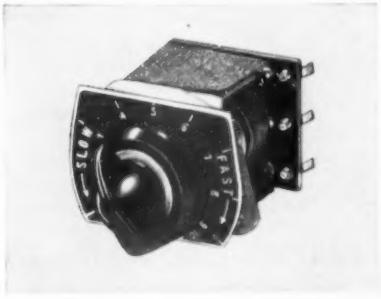

Rotating-type limit switch



G-E REDUCED-VOLTAGE MAGNETIC STARTER SOLVES POWER PROBLEMS

When load limitations prohibit motor starting at full voltage, this autotransformer-type starter controls and protects the operation of motor-driven pumps, conveyors, compressors, blowers, etc.

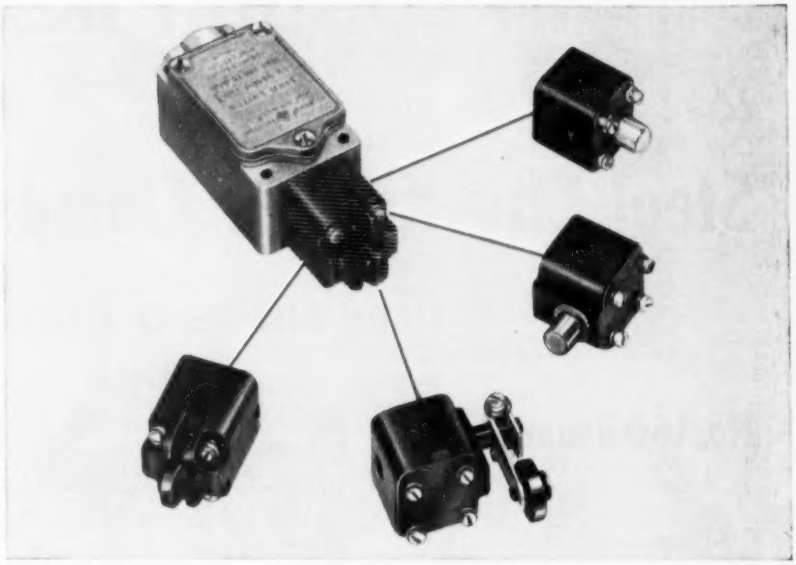
Available in air-break and oil-immersed designs, this hard-working starter for motors up to 250 hp utilizes the most modern materials and methods to give exactly the kind of operation you require for years to come.



NEW OILTIGHT POTENTIOMETER FOR CONTROL OF VARIABLE-SPEED MOTORS

This compact unit is part of the new G-E line of oiltight push buttons for use on a-c or d-c. It can be mounted in the standard G-E stations or enclosures or directly on the machine to be controlled. Ask for Bulletin GEA-5779 on the entire line of G-E oiltight push buttons.

SMALL G-E LIMIT SWITCH HAS FOUR INTERCHANGEABLE OPERATING HEADS FOR VARIETY OF APPLICATIONS



The basic contact unit—only slightly over two inches high—can be obtained with one of four different types of heads: roller lever, side pushrod, top pushrod, and roller pushrod. Case is oiltight—a gasketed cover keeps dirt and lubricating oils away from the contacts.

Little movement is required to operate it—18 degrees with a one-inch radius arm, 5/64 inch for the plunger type. Use this switch on machine tools, battery truck lift platforms, on small machines as a pilot device, and as a safety interlock on enclosing cases. Operates on a-c or d-c. Double-throw snap-action contact is easily accessible for wiring, and there is adequate room within the cast aluminum case for connecting to terminals, which are extra large. Bulletin GEA-5707.

NEW DUST-TIGHT/LINT-TIGHT G-E MANUAL MOTOR STARTER

For Motors Up to 7½ Hp

Listed by Underwriters' Laboratories and Factory Mutual, this starter for motors up to 7½ horsepower is completely dust tight. Special gaskets and cover fastenings keep dust from contacts—reduce the fire hazard. Two- three- and four-pole forms have bi-metallic overload relays with front-connected heaters. Switch lever moves to neutral position on overload, is vibration resistant.

Switch interior can be reversed in the enclosure for either top or bottom feed, and ON-OFF nameplate can be easily reversed.

For more information contact your nearest G-E representative, agent, or distributor, or write Section A730-45, General Electric Co., Schenectady 5, N. Y.

GENERAL ELECTRIC

For Better Jobs Quicker

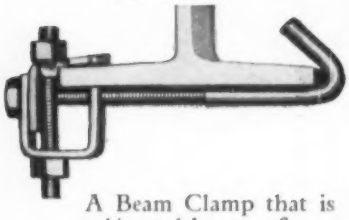
IN CONDUIT INSTALLATIONS

Use . . .

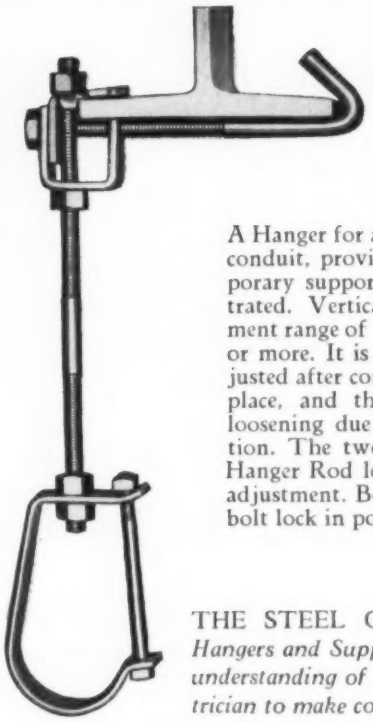
Steel City-Kindorf Clamps and Hangers

HERE ARE TWO EXAMPLES

No. 160 Beam Clamp
(PATENTED)



A Beam Clamp that is adjustable to flange width as well as adjustable to flange thickness without the use of set screws. It permits Hanger Rod adjustment and is load rated 500 pounds with a safety factor of five (5).



No. 150 Conduit Hanger
(PATENTED)

A Hanger for all sizes of conduit, providing temporary support as illustrated. Vertical adjustment range of 1½ inches or more. It is easily adjusted after conduit is in place, and there is no loosening due to vibration. The two nuts on Hanger Rod lock the Hanger after adjustment. Both head and nut on bolt lock in position.

There is a KINDORF DEVICE *for every need in hanging or supporting pipe or conduit.*

STEEL CITY REPRESENTATIVES *are located in principle cities to help solve your problems.*

THE STEEL CITY—KINDORF LINE *of Clamps, Hangers and Supports has been designed from a thorough understanding of their requirements and to enable the electrician to make conduit installations—from the simplest to the most complex—in an easy and low-cost manner, with a neat, workmanlike appearance. Write for any information desired.*

STEEL CITY ELECTRIC CO.

PITTSBURGH 33 PENNSYLVANIA

ELECTRICAL BOXES AND CONDUIT FITTINGS

KINDORF DEVICES FOR INSTALLING CONDUIT

Not one... not two... but A WHOLE TEAM of Insulating Products

The DUTCH BRAND Insulating Foursome

DUTCH BRAND Friction Tape

Here's a friction tape that is an "old timer" in the electrical field. Known and proven a quality product for over forty years. It does not fray . . . it is strong . . . has correct adhesion . . . makes firmly held joints and has long life on the job.

Its dielectric strength is 2000 volts for a single thickness. It costs no more to have this top quality . . . ask for DUTCH BRAND.

DUTCH BRAND Plastic Tape

Years of manufacturing experience and "know-how" are responsible for this outstanding product . . . made especially to meet electrical requirements. It is super-thin . . . with 150% stretch. It resists weather, oils, acids and corrosive chemicals. Dielectric resistance averages 1000 volts per mil of thickness. Available in regular .007" thickness or heavy duty .010" thickness for heavy duty work and for use with power driven tape machines. Be sure you get quality . . . get DUTCH BRAND Plastic Tape the next time you order.

DUTCH BRAND Rubber Insulating Tape

DUTCH BRAND Insulating Tape fuses instantly without heat and has the strength and stretch necessary for good joints. It resists up to 18,000 volts through a single thickness. It contains no corrosive chemicals . . . its long life makes it dependable. DUTCH BRAND Rubber Insulating Tape serves a very definite unreplaceable service in meeting many electrical insulating requirements. DUTCH BRAND Electrical Tapes are available at your electrical wholesalers . . . order a supply today.

"DB" Wire Connectors

"DB" Wire Connectors are DUTCH BRAND top quality products that are made to exacting specifications. Made of phenolic material and designed with long skirt for full insulating protection, they are weatherproof . . . vibration proof and resist pull-out. The knurled design makes them easy to handle and apply. They are available in four standard sizes. The next time you order DUTCH BRAND electrical tape also order your supply of "DB" Wire Connectors.

Order from your Electrical Wholesaler

DUTCH BRAND

VAN CLEEF BROS. INC.

Manufacturers of Rubber Products

DIVISION OF Johns-Manville

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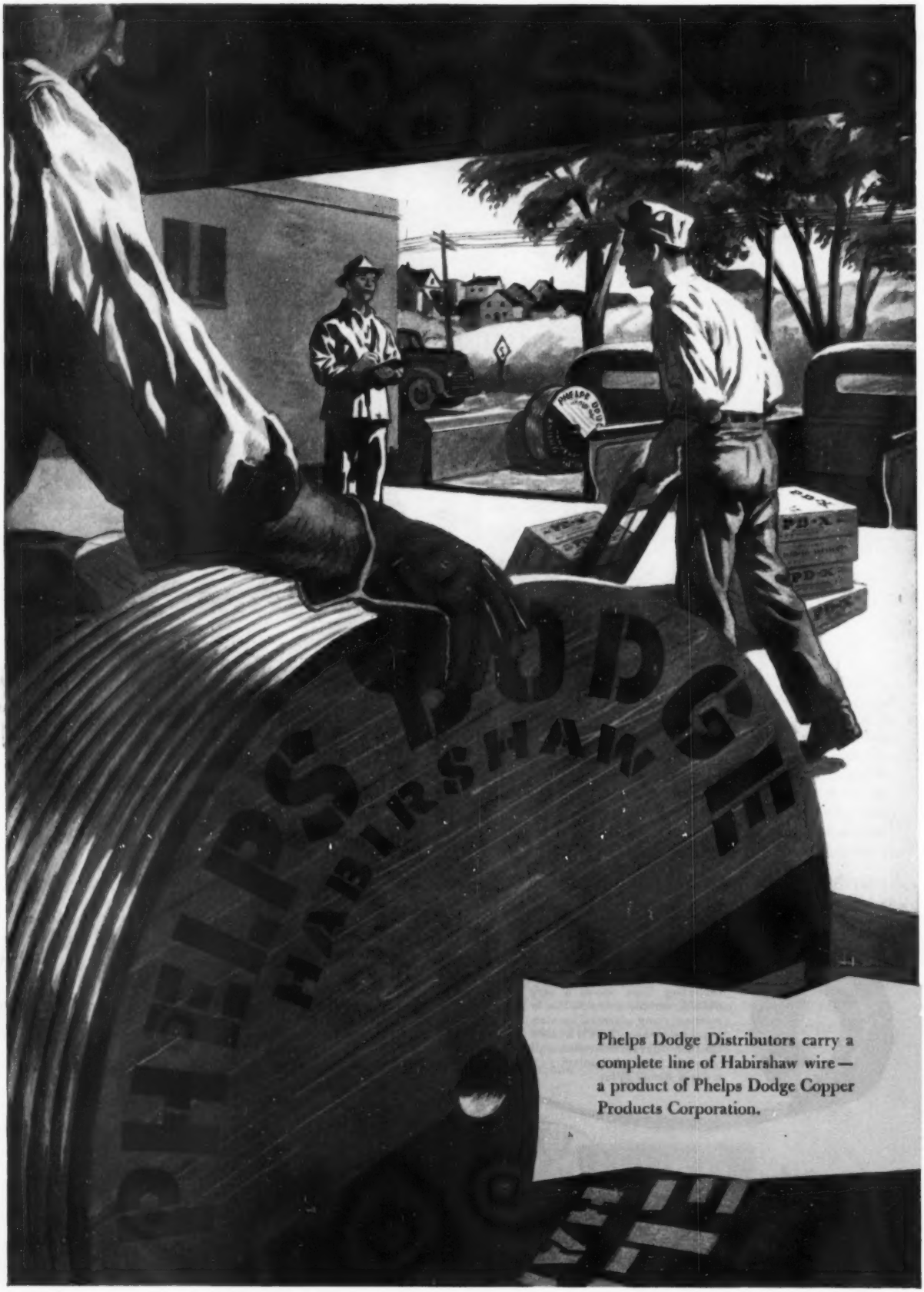


Phelps Dodge Distributors carry a complete line of Habirshaw wire—a product of Phelps Dodge Copper Products Corporation.

SEE YOUR PHELPS DODGE DISTRIBUTOR FOR

QUALITY and SERVICE

THAT SIMPLIFY YOUR JOB!

It's easier to maintain a reputation for the highest quality materials, the most dependable job performance, when you rely on a Phelps Dodge Distributor for your wire requirements.

Your distributor's personal background of experience is backed by Phelps Dodge's engineering "know-how" which is available when needed.

PHELPS DODGE COPPER PRODUCTS CORPORATION

WIRE BY PHELPS DODGE MEANS WIRED FOR LIFE!

TESTING TIPS for the maintenance of plant equipment

FEEDER CAPACITY SURVEYS DIFFICULT

Spot Power Losses Easily with Hook-on Power Factor Meter

This hook-on power-factor meter enables you to measure power factor without interruption of service. The Type AK-3 can be used on any balanced 3-phase circuit. When making capacitor surveys, you'll find this General Electric meter a valuable time saver. Improved power factor means relief to overloaded feeder circuits and transformers.

DIRECT READING

Since the AK-3 is direct reading, no calculator cards or interpolation is required; just clip on the voltage leads, clamp the hook around the line.

Power factor is important when you are trying to obtain the maximum capacity from factory circuits. Capacitors are one of the quickest and least-expensive ways of improving power factor and increasing feeder capacity. They can permanently release up to 30% more electrical capacity in your power system. The table below shows what you can expect from adding capacitors to your feeder lines. Accurate to within 0.05 PF, the AK-3 can be used on a-c circuits with voltages from 100-600 volts and currents from 15-600 amperes. Available from stock the AK-3 is only $87.00*. Send for more information in Bulletin GEC-901.

if your power factor is now	you can release this much extra capacity	with this many capacitors for each 100 kw of load
65%	34%	84 kvar
70%	29%	69 kvar
75%	23%	55 kvar
80%	17%	42 kvar
85%	11%	29 kvar
90%	5%	15 kvar

(Power factor is raised to 95%. New load is at original power factor.)

A-C Portable Speeds Lighting Circuit Checks

General Electric's Type AP-9 (AC) and DP-9 (DC) portable testing instruments are used for production testing, maintenance work, and trouble investigations where precise measurements are required.

Their accuracy of ¾ of 1% for a-c and ½ of 1% for d-c makes these lightweight instruments well suited for quick lighting checks for under- or over-voltage, or for application in industrial and educational laboratories.

DEPENDABLE OPERATION

Large clearances between moving and stationary parts assure you of maximum dependable operation. Available in a variety of ranges in both a-c and d-c ratings, these instruments can also be obtained with pointer-stop mechanism for measurement of starting currents and voltage dips.

Price of these instruments is $42.00* and up. Send for additional information in Bulletin GEC-830.

G-E PORTABLE RECORDER IDEAL FOR VOLTAGE REGULATOR CHECKS

Pasadena Municipal Power and Light Dept. is currently obtaining satisfactory voltage checks by using the General Electric Type CF-1 recorder reports A. Leonard Stevenson, Supervisor, Meter Test Division.

REGULATORS CHECKED

Mr. Stevenson, shown in the photo above, says that regulator relays "are checked once a month to maintain standard voltages. Located in distribution centers for circuits, our CF-1's check the regulators to see that they are correctly compensated. The recorders are used whenever a circuit cut is made for adding or decreasing power. This instrument is more accurate than those previously used—its flexibility and adaptability make it a thoroughly satisfactory instrument."

30-DAY CHARTS AVAILABLE

You can get accurate records over an extended period of time with a G-E Type CF inkless recorder. Designed for dependability and maximum convenience, it can run as long as 30 days without attention, and has a weather seal for outdoor service. Simply put it on the line; it records volts, amps, or single-phase watts—just the information you need to determine what corrective action is necessary. The CF inkless recorder has an accuracy up to 1½ per cent of full scale value. Price of voltmeter (0-140/280 volts): $147.47*. More details in Bulletin GEC-215.

**Mfgr's suggested retail price.*

When ordering bulletin write to Section 602-253, General Electric Company, Schenectady 5, N. Y.

BUY NOW

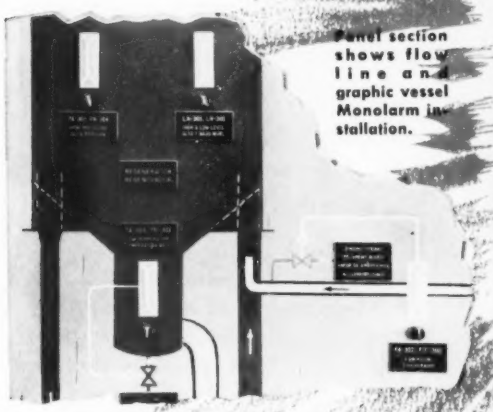
From Your Nearest G-E Distributor

GENERAL ELECTRIC

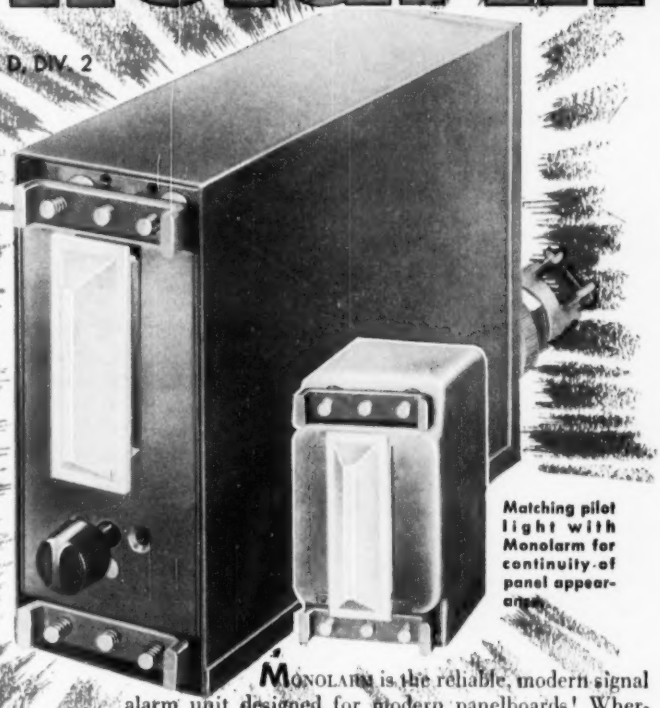
Announcing . . . **R&S Monolarm®**

CLASS I, GROUPS C & D, DIV. 2

. . . the *Compact* signal alarm unit ideal for flow line and graphic panels



Panel section shows flow line and graphic vessel Monolarm installation.



Matching pilot light with Monolarm for continuity of panel appearance.

MONOLARM is the reliable, modern signal alarm unit designed for modern panelboards! Wherever instrumentation space is at a premium—wherever flow lines and graphic vessels must tell their visual processing story without interference from bulky signal alarms—this exclusive R & S development takes over with minimum space on front and back of panels.

Monolarm offers instant warning against any abnormality occurring in a processing operation at any time—and safeguards against expensive losses of production and materials. Should any abnormality occur, the normal light ceases to shine . . . the alarm light flashes rapidly on and off . . . also an external howler, if used, is sounded. Acknowledgment by the operator must be made by turning the re-set switch . . . the alarm light then assumes a steady state until the condition is remedied . . . then Monolarm automatically resumes its normal indication.

Several hundred highly successful installations are already completed. Monolarm is now available on your order.

Advantages of R&S MONOLARM

1. A single narrow bezel and button fits into a flow or graphic line diagram without interrupting the continuity of the design story.
2. Occupies minimum back-of-panel mounting space.
3. Lighting indications in two or three colors on *one* bezel.
4. Relamping is quick and easy from the front of the panel.
5. Instantaneous connect and disconnect of the power supply cable to Monolarm is provided by an interlocking switch receptacle and plug.
6. Maximum safety is afforded by interlocking the plug with the hermetically sealed switch, making it impossible to insert or withdraw plug under load. When the polarized plug is inserted into the receptacle and the plug shell is turned clockwise, it turns the switch to the "On" position and vice-versa.
7. Hermetically sealed plug-relays instantly removable if replacement is necessary.
8. Time delay circuit available to counteract turbulence and vibration when abnormal condition is reached.

• *Write for Sales Data Sheet #21253— 4*

RUSSELL & STOLL COMPANY, INC. • 125 BARCLAY STREET, NEW YORK 7, N. Y.

RUSSELL & STOLL

PRECISION BUILT ELECTRICAL EQUIPMENT SINCE

Pays for itself...if it "trips" just once!

I-T-E Circuit Breakers restore service in seconds...save you valuable production time on power interruption

Ever stop to think of it? The very first time an I-T-E Circuit Breaker "trips" on short circuit or overload, it can easily pay for itself many times over—just in the production time it saves!

I-T-E Circuit Breakers restore service in *seconds* after trouble has been cleared. Simply resetting the operating handle is all it takes to restore power and start up production again.

Service in seconds is one of the many outstanding advantages of modern I-T-E Circuit Breakers. You don't have to waste precious production time searching for replacement parts. There's no risk of costly downtime, damaged machinery, ruined production.

False economy can be very expensive. Especially when it comes to critical electrical protection. For dependable *production assurance*, guard your vital power arteries with modern industrial-type I-T-E Circuit Breakers. You can count on positive electrical protection and quick restoration of service.

Think it over and you'll be convinced. I-T-E Circuit Breakers are the most efficient, economical circuit protection you can buy. For full details on the complete line of I-T-E Molded Case Circuit Breakers—from 10 to 600 amperes, up to 600 volts a-c, up to 250 volts d-c—see your I-T-E distributor or send for *Bulletin 5108D* today.

● I-T-E 100-ampere "F" frame circuit breaker in Nema Type 1-A sheet steel enclosure. Three-position operating handle indicates at a glance whether circuit breaker is ON, TRIPPED, or OFF. No specialized personnel required to restore service. *Anyone* can reset circuit breaker to restore service in seconds.

I-T-E

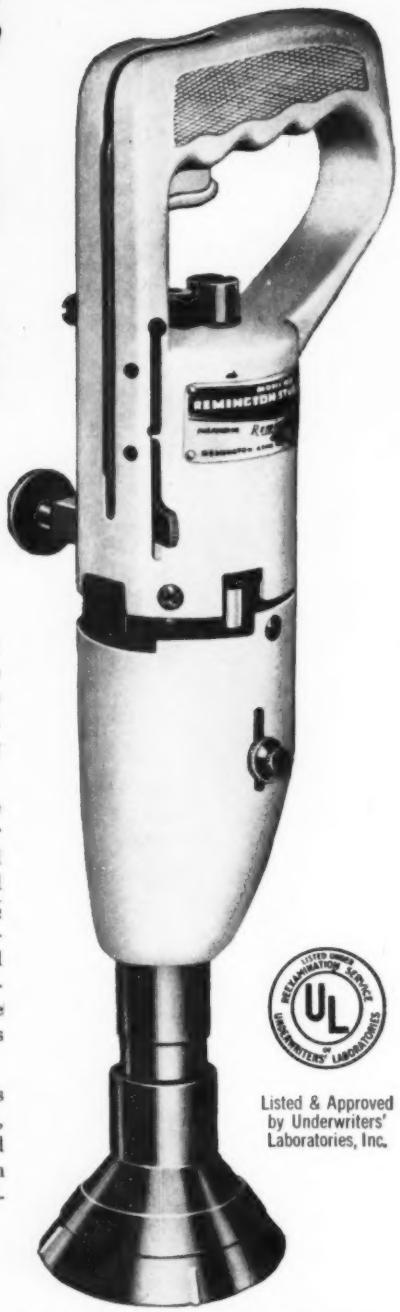
MOLDED CASE CIRCUIT BREAKERS

I-T-E CIRCUIT BREAKER COMPANY • 19TH & HAMILTON STREETS • PHILADELPHIA 30, PA.

You can drive studs ARROW STRAIGHT into steel or concrete with

MODEL 450 REMINGTON STUD DRIVER

The widest power range of any powder-actuated tool!



The Model 450 Remington Stud Driver is the most efficient fastening method in use today. Its exclusive advantages are unequaled by any other powder-actuated tool.

You get consistently straight driving on every type of fastening job with the long heel cap on all Remington cartridges. It acts as a perfect gas seal and provides extra power. These colored heel caps clearly mark the six different 32-caliber power loads that are available. You can select the *right* cartridge for each job quickly and easily.

The Remington Stud Driver needs no separate parts for power control or loading—nothing to lose or break. Just a twist of the wrist opens the Model 450. Insert stud and power cartridge as a unit . . . close and you're ready. Triple safe, this superior tool has a separate lever that must be depressed and *held* with one hand before and during squeezing of the trigger with the other hand. Two *additional* devices prevent operation except in proper fastening position.

Completely self-powered, the Model 450 sets up to 5 studs per minute in fastening steel or wood structural pieces to concrete or steel surfaces. Its light weight—only 5½ pounds—makes it ideal for use overhead or in confined spaces. To speed operation further, an exclusive ejector snaps the fired case out of the tool instantly—no fumbling, no tools needed.

Test-proved to be the world's finest and speediest fastening system, the Model 450 Remington Stud Driver is made by Remington Arms Company, Inc., *America's oldest sporting arms manufacturer.*

Listed & Approved by Underwriters' Laboratories, Inc.

MAIL THIS COUPON TODAY

Industrial Sales Division, Dept. ECM-3
Remington Arms Company, Inc.
939 Barnum Ave., Bridgeport 2, Connecticut

Please send me my *free* copy of the new booklet showing how I can cut my fastening costs.

*Name*_____

*Position*_____

*Firm*_____

*Address*_____

*City*_____ *State*_____

NEW, FREE BOOKLET shows you a hundred different ways the Model 450 Remington Stud Driver can speed *your* construction fastening. Packed with illustrations, it tells you where and how this tool can save time, reduce fatigue and cut costs. Send in the coupon below for your copy.

"If It's Remington—It's Right!"

Remington DUPONT

A negative approach to POSITIVE BENEFITS

CLARK TYPE "CY" starters have

No trick mounting problems

No crowded wiring spaces

No lack of concentric knockouts

No installation troubles

No parts back-removable

No tools needed for inspection

No loose screws in contact arm

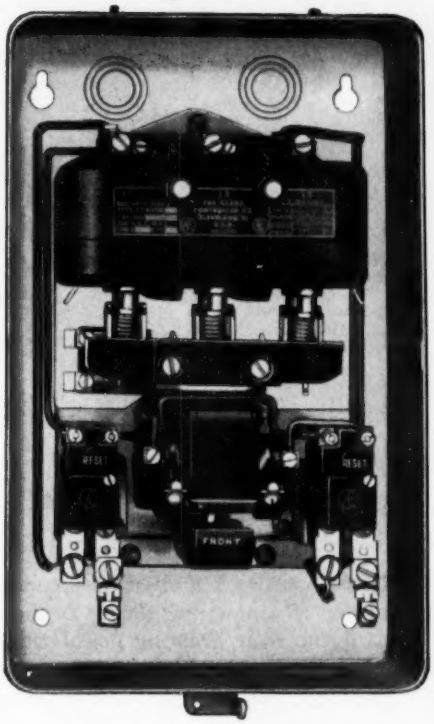
No single-break contacts

No carbonizing in arc chamber

No overload difficulties

No burning in steel arc space

No openings in top of arc shell



This string of positive *"NO's"* is supplemented by a long list of affirmatives that make CLARK Type "CY" STARTERS the ideal line for Distributors to stock.

Contractors installing CLARK Type "CY" STARTERS are building satisfied customers for repeat business when new installations are made.

So—when you buy, you'd better try **CLARK TYPE "CY"**

THE CLARK CONTROLLER CO.

ENGINEERED ELECTRICAL CONTROL • 1146 EAST 152ND STREET, CLEVELAND 10, OHIO

The New Louisiana Purchase

EVERY day America crosses a frontier—the frontier of a new market. It is the market created by an ever growing population. Since Pearl Harbor, our population has increased 23½ millions—more than all the people now living in the region west of the Mississippi once called the Louisiana purchase, that vast billion-acre area which provided us with geographical frontiers for a hundred years.

During 1952, 8,500 babies were born daily, increasing our population by nearly 3,000,000 people. New families and bigger families need more and bigger houses, more food, clothing, cars, roads, hospitals, churches, schools. Their needs call for continuing and increasing production from farms and factories.

There are those among us who say a decline in government spending will bring depression. But where is there room for depression when we add the population of another Minnesota or an Iowa to our nation each year—when the need for goods and services increases steadily? In fact, only by tapering off our vast programs of government spending can industry and business hope to provide sufficient goods to maintain our present standard of living and satisfy the demands of our ever growing population.

Let no one tell you America has crossed its last frontier.

QUALITY YOUNGSTOWN SERVICE

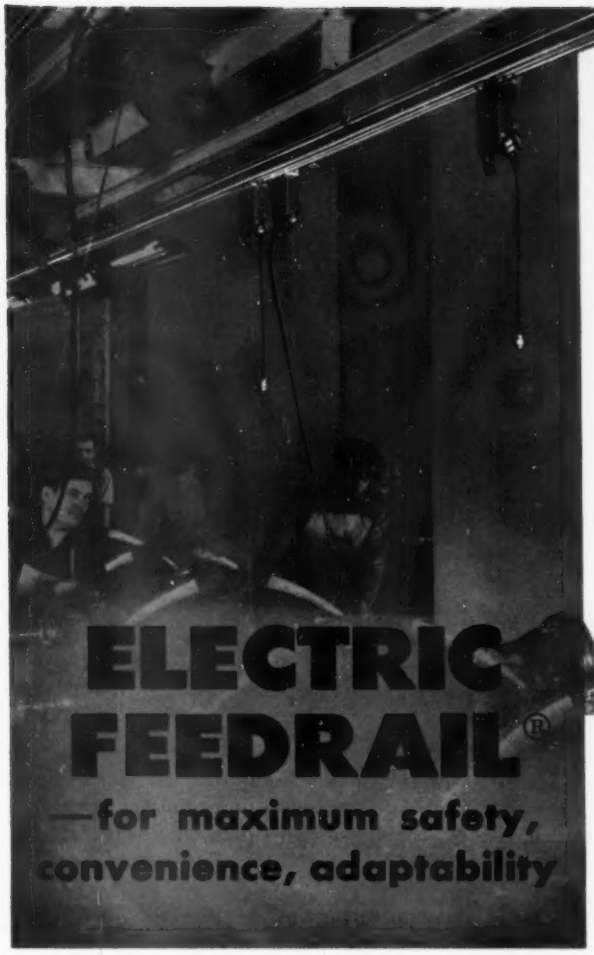
The Youngstown Sheet and Tube Company

General Offices--Youngstown 1, Ohio

Export Offices--500 Fifth Avenue, New York

MANUFACTURERS OF CARBON ALLOY AND YOLOY STEELS

RAILROAD TRACK SPIKES - CONDUIT - HOT AND COLD FINISHED CARBON AND ALLOY BARS - PIPE AND TUBULAR PRODUCTS - WIRE - ELECTROLYTIC TIN PLATE - COKE TIN PLATE - RODS - SHEETS - PLATES.



Power Outlets that move with the tools

The FEEDRAIL system of electrification is ideal for powering portable tools on both moving and stationary production lines. It provides overhead power outlets that give your tools the full run of the production line or any part of it. And it means short electric power cables up out of the way. It also gives your production lines maximum versatility because you can change tools by simply disconnecting one and plugging in another. With ELECTRIC FEEDRAIL you're set for today's production — and tomorrow's. Without obligation, a field representative will call and give you the facts about FEEDRAIL for your needs. There's one near you.

Write for descriptive literature which gives you full details about ELECTRIC FEEDRAIL, including facts and data on capacities, installation, planning and the preparation of specifications.

Sold by leading electrical distributors

52-4 Rev.

Never Becomes Obsolete

ELECTRIC FEEDRAIL®

FEEDRAIL CORPORATION

Subsidiary of Russell & Stoll Company, Inc.

125 BARCLAY STREET • NEW YORK 7, N. Y.

SPECIALLY QUALIFIED REPRESENTATIVES IN PRINCIPAL CITIES

FIRST on all counts!

NATIONAL ELECTRIC'S

new "LO-LOSS" feeder bus

The *new* "Lo-Loss" Feeder Bus was designed for the transmission of electric current up to 4000 Amperes at 600 Volts or less. Ideal for welding and other low power factor loads.

EFFICIENCY—Insulated copper bars mounted on close centers provide low reactance, low voltage drop, minimum temperature rise.

TOUGHNESS—#12 gauge channel frame supporting insulators makes it *toughest in the business.* Recent independent, unbiased tests prove "Lo-Loss" can take it—100,000 RMS Amperes at 440 Volts! Details on request.

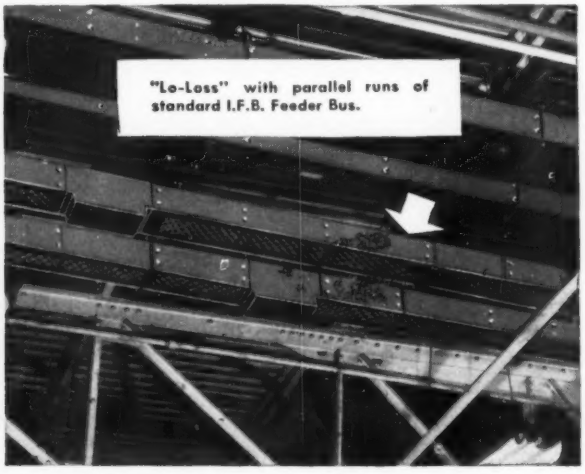
COMPACTNESS—Composite drawings comparing size of "Lo-Loss" with other busways prove why it is ideal for remodeling jobs where space is at a premium.

FLEXIBILITY—Can be installed in any position with bars in vertical or horizontal position. Readily adaptable to industrial or commercial installations. Approved for vertical mounting when used for risers.

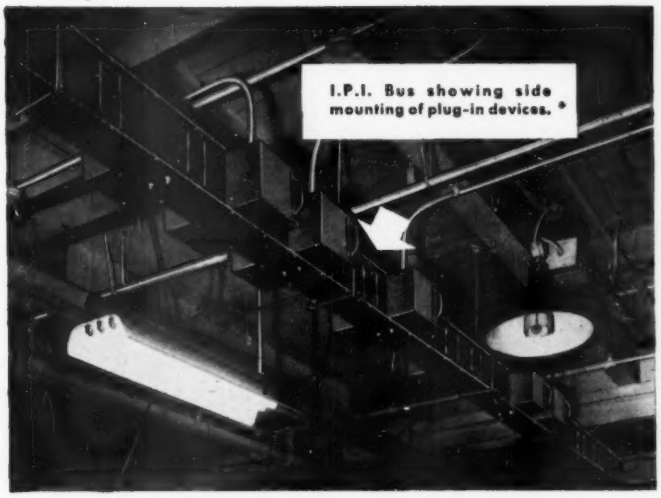
INSTALLATION EASE—Factory built, ready for installation.

Write for new Busway Catalog and Sample Specifications

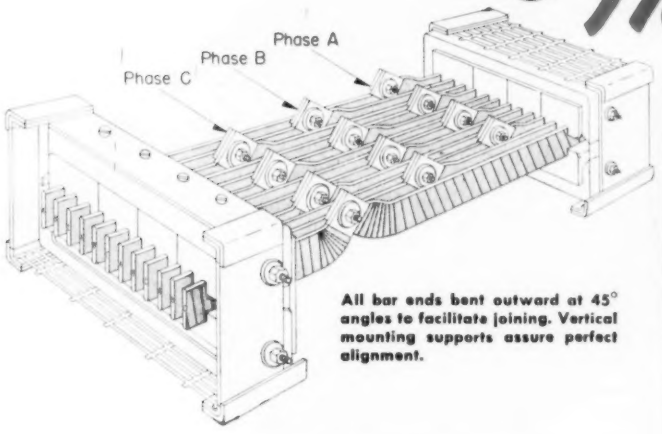
"Lo-Loss" Feeder Bus with offset to lift bus above travelling crane level.



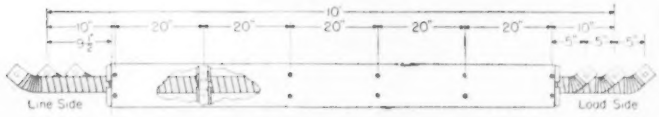
"Lo-Loss" with parallel runs of standard I.F.B. Feeder Bus.



-finest in the field...

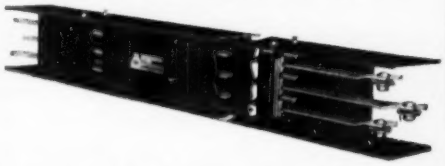


All bar ends bent outward at 45° angles to facilitate joining. Vertical mounting supports assure perfect alignment.



Full length side view "Lo-Loss" Feeder Bus cutaway shows insulator section.

NATIONAL ELECTRIC I. P. I. "PLUG-IN" BUS



"Plug-In" Bus is an enclosed busbar system for distributing electrical power. Consists of standard 10 ft. lengths complete with ells, tees, crosses, feed-in and tap-off fittings, expansion joints and closers. Plug-in openings, staggered on two sides, permit insertion of devices convenient to equipment.

Listed by Underwriters' Laboratories, Inc.

Sold through leading electrical wholesalers.

EVERYTHING IN WIRING POINTS TO

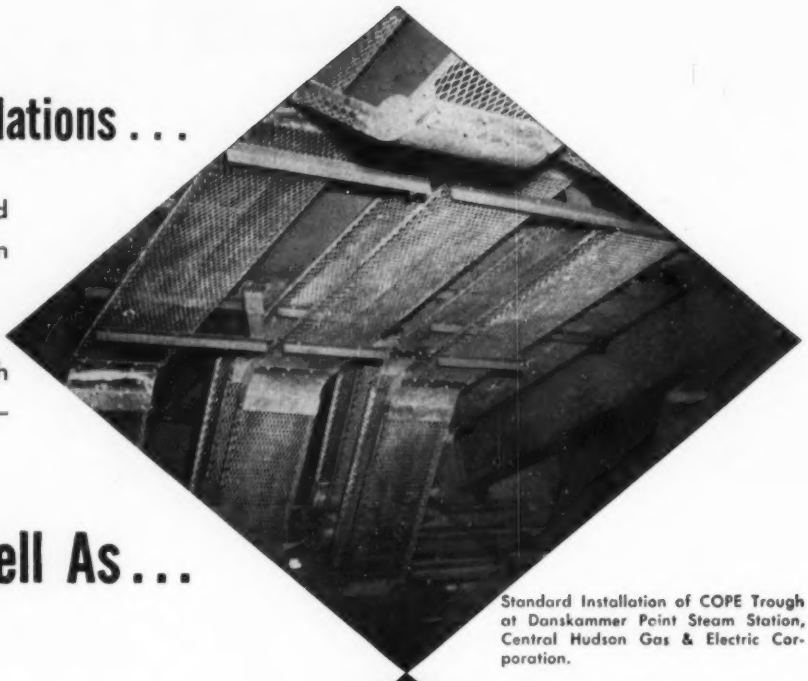
National Electric Products

PITTSBURGH, PA.

3 Plants • 7 Warehouses • 34 Sales Offices

For Most Cable Trough Installations . . .

Our exhaustive list of standard COPE Cable Trough parts can easily be worked into your plans. The simplified design of standard COPE Cable Trough actually saves you three ways — materials, labor and costs.

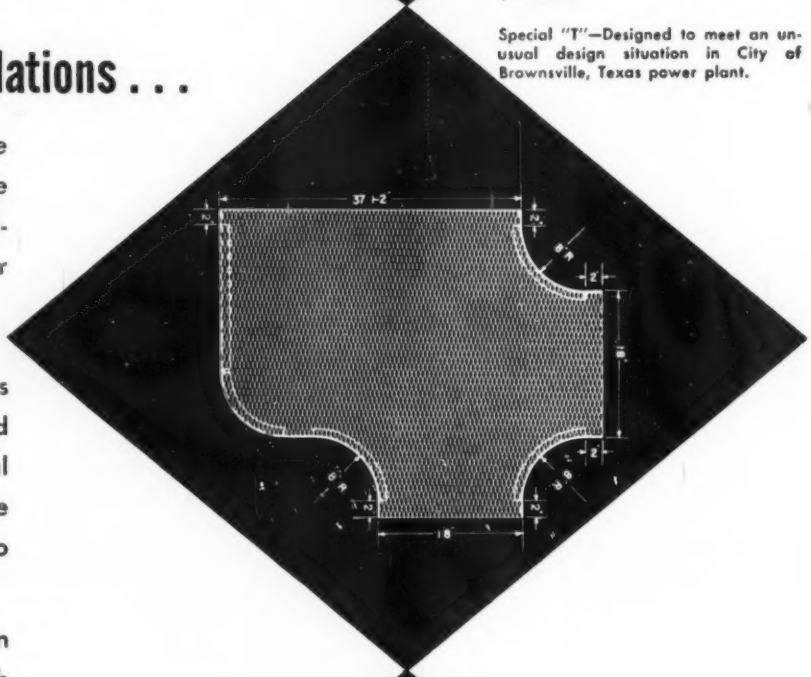


Standard Installation of COPE Trough at Danskammer Point Steam Station, Central Hudson Gas & Electric Corporation.

As Well As . . .

For Unusual Cable Trough Installations . . .

Where the standard COPE Cable Trough cannot answer those "special situations," COPE Engineers will help you with your problem. We will, as we have for hundreds of users, furnish special fittings. All we require is an outline of your problem and we will then design any special fittings necessary to adapt the standard COPE Cable Trough to your specific job.



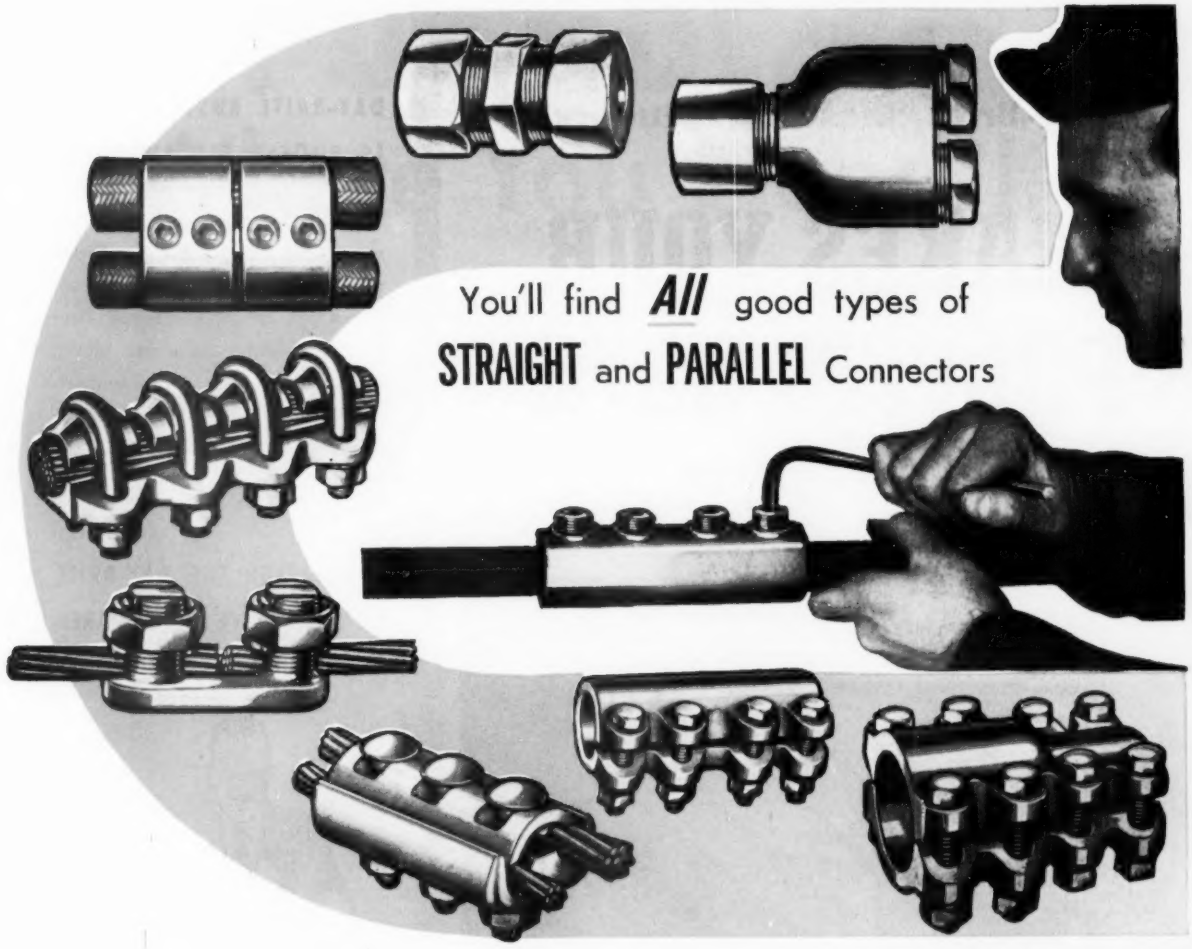
Special "T"—Designed to meet an unusual design situation in City of Brownsville, Texas power plant.

Please request full information on standard COPE Cable Trough from us today.

T. J. COPE, INC., 711 SOUTH 50th ST.
PHILADELPHIA 43, PENNSYLVANIA

T. J. Cope INC.

You know Cope by these products



You'll find ***All*** good types of
STRAIGHT and **PARALLEL** Connectors

in the ***Complete*** line

Yes, it's mighty handy to open your Penn-Union Catalog and pick the exact type you need. They're all there—in a complete range of sizes; Bolted straight connectors . . . screw type . . . various split sleeve types . . . shrink fit . . . universal clamps . . . E-Z connectors with yoke and nut, etc.

The Penn-Union Catalog also gives you the *complete* line of service Connectors, Tees, Cable Taps, Grounding Connectors, Lugs, Power Connectors, etc.

Preferred by leading users—who have found that *"Penn-Union" on a fitting is their best guarantee of unfailing service.*

Sold by Leading Wholesalers

PENN-UNION ELECTRIC CORPORATION, Erie, Pa.

Canada: Dominion Cutout Company, Ltd.
250 Richmond St., West, Toronto

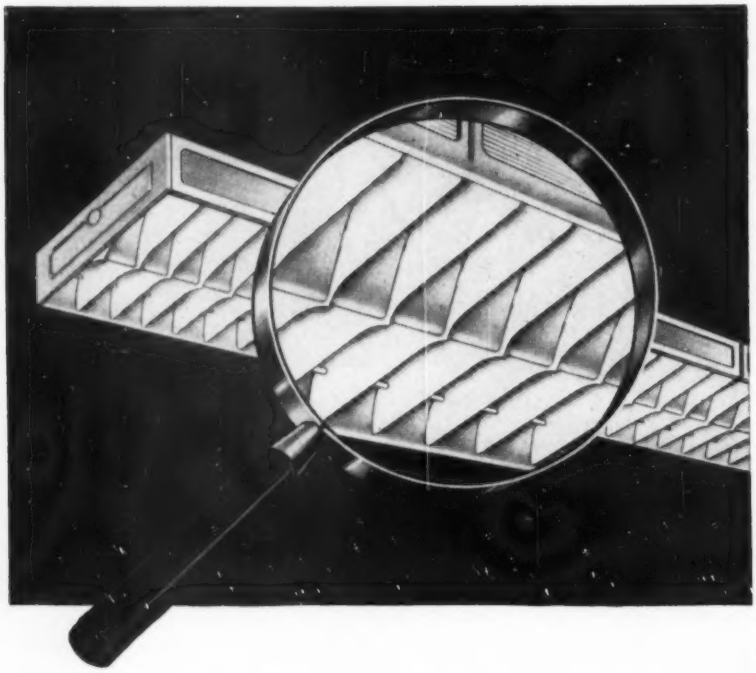
THE *Complete* LINE OF CONDUCTOR FITTINGS

PENN-UNION

Day-Brite "Close-up" Quality

MAKES YOUR PROFITS SAFE

because it makes satisfied customers



THIS IS A CLOSE-UP of the *interlocking louver* feature of Day-Brite's PLEXOLINE® fixtures. Each cross-wise louver is firmly locked into the center "V" louver and is tied at both ends by a steel rod. The whole shielding unit is rigid. It won't sag. It won't rattle. Louvers will not twist or bend out of shape during installation or when the fixture is being cleaned or relamped.

THIS "CLOSE-UP" QUALITY FEATURE is important to you because it helps make installation easier, faster and more profitable. It means *safer profits* through elimination of costly, time-consuming "call-backs."

310

DAY-BRITE BUSINESS IS PROFITABLE BUSINESS

Day-Brite is a contractor's line—designed and built to cut installation time and help you make more money. When you specify and install Day-Brite you *keep* those bigger profits, too. Day-Brite makes satisfied, enthusiastic customers—the kind that recommend you to other prospects instead of haunting you with profit-robbing "call-backs."

YOU'LL FIND THE DAY-BRITE REPRESENTATIVE IN YOUR AREA HELPFUL AND COOPERATIVE

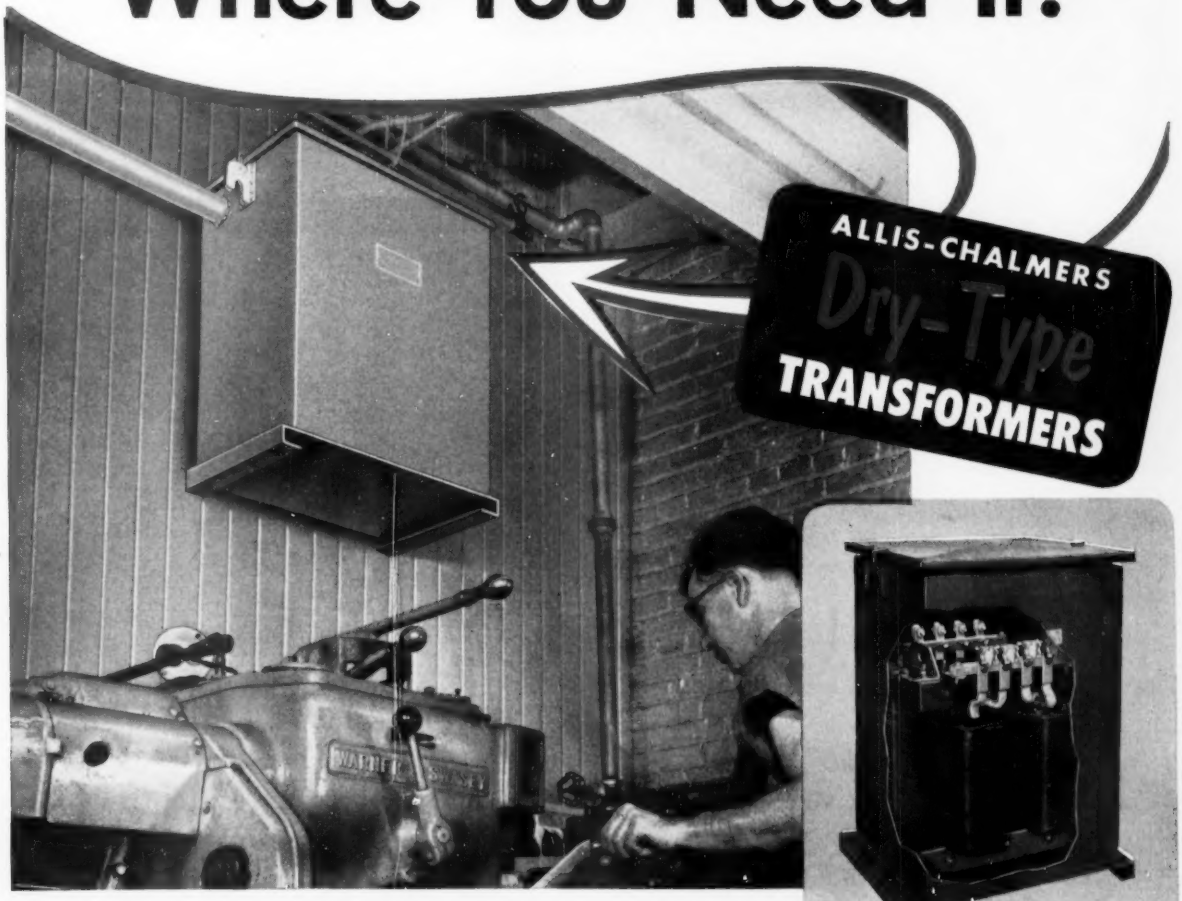
There are Day-Brite representatives in 45 cities across the nation. If you're not already acquainted with your nearest Day-Brite representative write today for his name and address. You'll find him an experienced, competent lighting man and he has information that can make your business better.

* * *

Day-Brite Lighting, Inc., 5402 Bulwer Ave., St. Louis 7, Mo. In Canada: Amalgamated Electric Corp., Ltd., Toronto 6, Ontario.

"DECIDEDLY BETTER"
DAY-BRITE
Lighting Fixtures

PUT POWER Where You Need It!



HERE'S THE WAY to assure rated voltage for motors and other equipment. Install Allis-Chalmers dry-type transformers close to the load to provide full voltage for efficient motor operation, flicker-free lights, and full heating of thermal equipment.

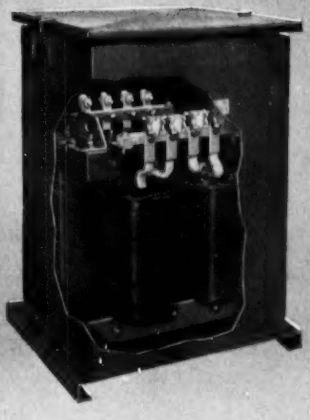
You can mount them anywhere, on posts, beams or walls, in a small amount of space, or right on the machine itself. You don't need vaults or expensive enclosures.

Installation is easy because junction boxes are eliminated. Knockouts are provided for connecting conduits directly to the transformer case. System cables are connected to the transformer terminals in compartments.

Maintenance is easy, too. You install Allis-Chalmers transformers and forget them except for periodic inspections. There are no insulating liquids to maintain; no gauges or gaskets to fuss with.

Get more information from your Allis-Chalmers district office, or write Allis-Chalmers, Milwaukee 1, Wis.

A-3980

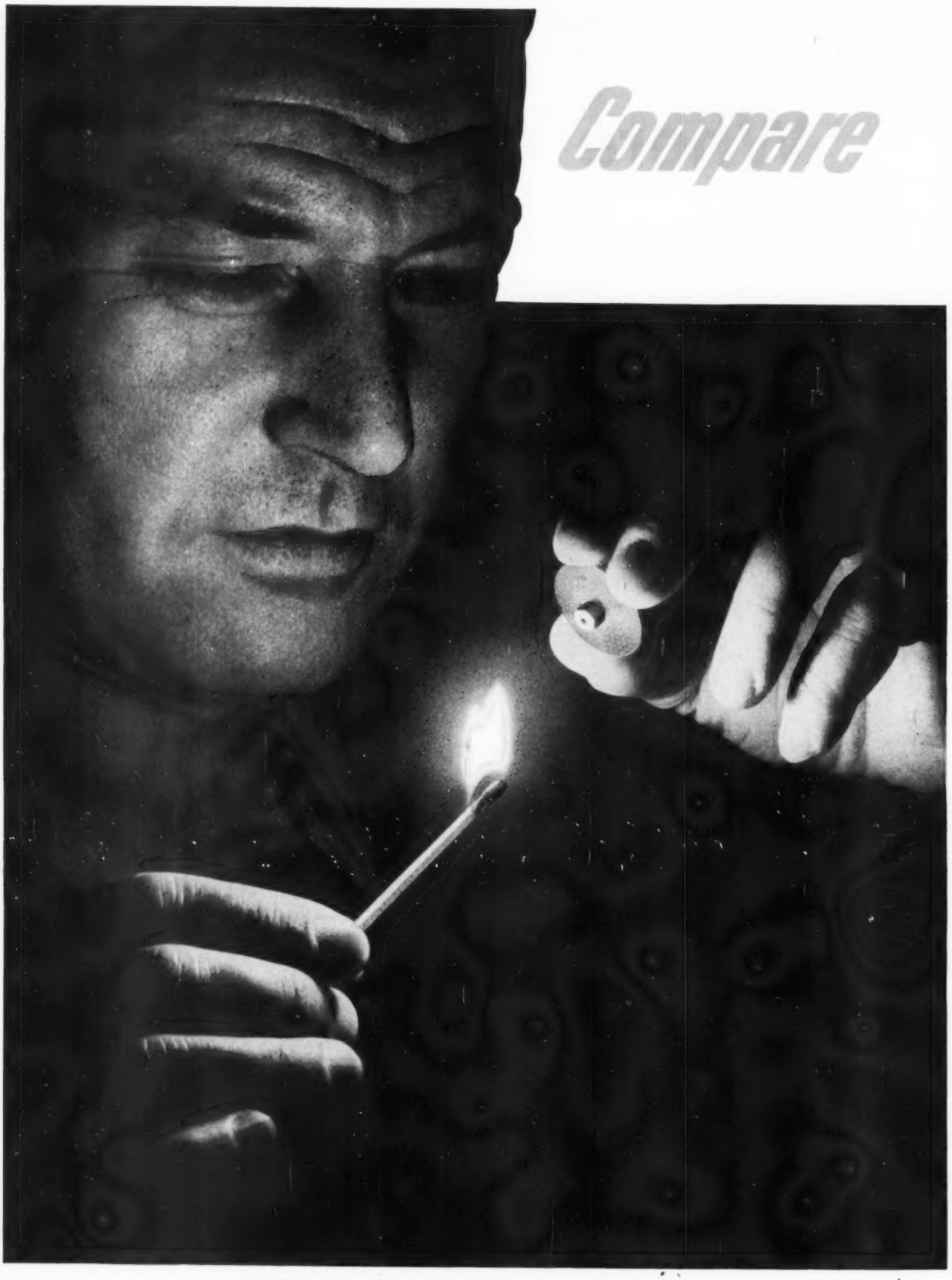


IT'S ENDURANCE BUILT

Core and coil assembly is impregnated to guard against moisture and dirt. All-welded, modern looking case protects the internal assembly. Case is Spra-Bonderized to protect it against corrosion. Three coats of baked-on alkyd resinous paint furnish additional protection.

Ratings 167 kva and smaller (single phase); 300 kva and smaller (three phase); 600 volts and below.

ALLIS-CHALMERS


Compare

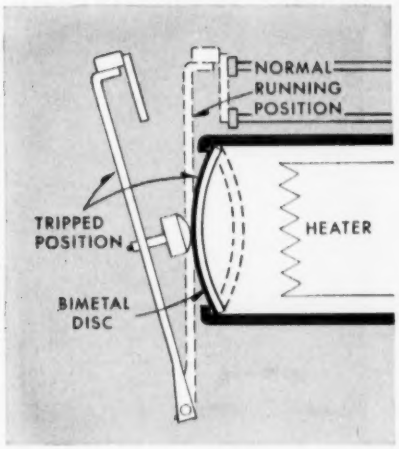
Life-Line starters by this simple demonstration

Proof that Life-Line Starters give you instant, positive motor protection

See this flame test. When heated and placed upon a flat surface, this bi-metal disc will snap up into the air. Here is sin.ple action—demonstrated right before your eyes—powerful, positive action to protect your motors from the destroying heat of dangerous overload.

The bi-metal disc is the nerve center of the overload relay designed into every Westinghouse Life-Line Starter. The disc accurately stands watch over the build-up of motor heat, because a motor can become overloaded. At precisely the right instant, just before a motor may be dangerously overloaded, the disc snaps, as in the flame test. This causes starter contacts to open lightning fast, protecting your valuable motor.

Only Westinghouse Life-Line Starters have the bimetallic, snap-action, disc-type overload relay . . . the most precise motor protective device you can buy. But, just as important, the bi-metal maintains its precision calibration for the life of the starter. It will not fail because it cannot fatigue, age or oxidize. Premature, or "hot" resets can ruin other types of overload relays, such as the solder-pot. Remember—the price of poor protection is smoldering, useless motors, costly motor rewind jobs, other damaged equipment, down time and expensive production pile-ups.



Westinghouse bi-metal principle of overload relay protection, dependable for the full life of the installation.

Proof that Life-Line Starters are tough, maintenance free

Simplicity of design, fewer and more rugged components, only one moving element . . . all spell toughness and long life in Westinghouse Life-Line Starters. Parts that aren't there, can't wear.

Call your Westinghouse Representative to see the flame test. Or write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-30146

YOU CAN BE **SURE**... IF IT'S **Westinghouse**

USED THE MOST FROM COAST TO COAST

For many years Contractors from Coast to Coast have used Briegel All Steel Indenter Fittings. U. L. approved as concretetight and for general use, B-M Indenter Fittings are faster, easier to use and neater in appearance.

Installation is simple and less expensive. Two quick squeezes sets them forever. Try B-M Indenter Fittings and get more profits from each job!

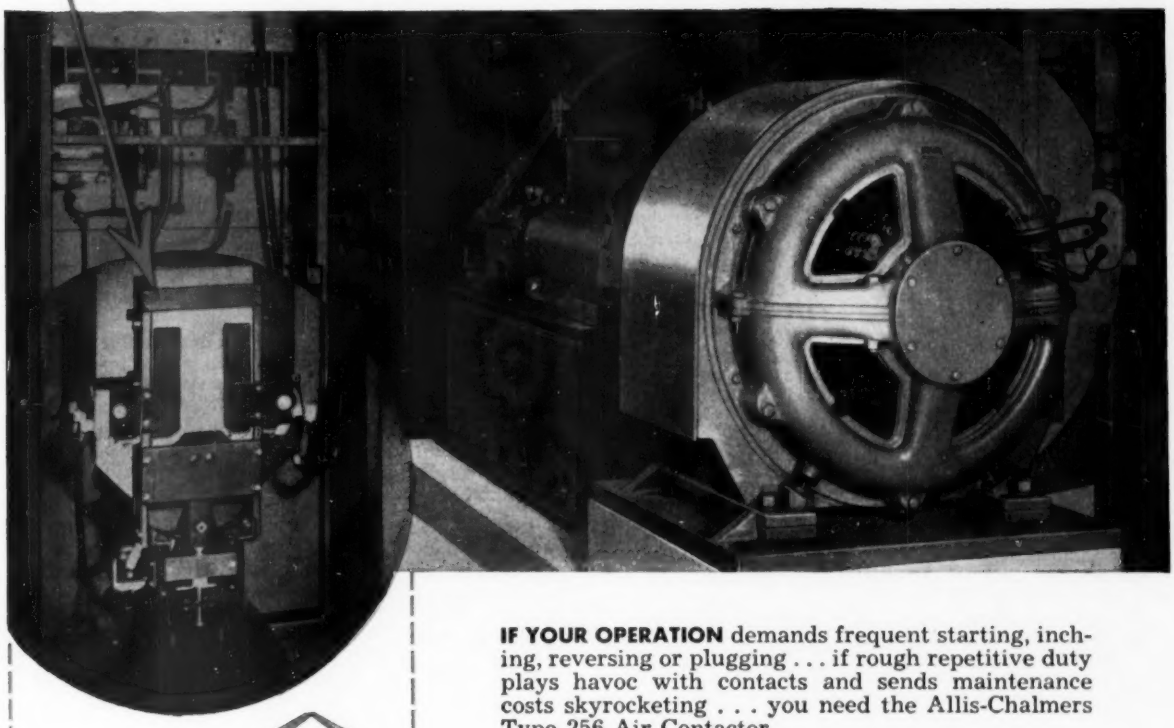
BRIEGEL METHOD TOOL CO.
GALVA, • ILLINOIS

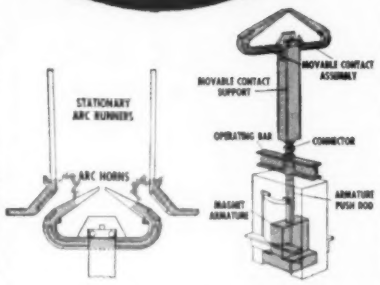
Distributed by

The M. B. Austin Co., Northbrook, Ill.; Clayton Mark & Co., Evanston, Ill.; Nikoh Tube Co., 5000 South Whipple St., Chicago, Ill.; Clifton Conduit Co., Jersey City, N. J.; The Steelduct Co., Youngstown, Ohio; Columbia Cable & Electric Corp., 255 Chestnut St., Brooklyn, N. Y.; Pittsburgh Standard Conduit Co., Pittsburgh, Penn.; Wagner Malleable Products Co., Decatur, Ill.; J. R. Richards Co., Carnegie, Penn.; Kondu Mfg. Co., Ltd., Preston, Ont.

ALLIS-CHALMERS
TYPE 256
Air Contactors

CUT Maintenance Cost





Double-break contacts, vertical action, dual blowout structure and other features speed arc extinction . . . assure long life and low maintenance.

IF YOUR OPERATION demands frequent starting, inching, reversing or plugging . . . if rough repetitive duty plays havoc with contacts and sends maintenance costs skyrocketing . . . you need the Allis-Chalmers Type 256 Air Contactor.

No Turning Shafts — No Shaft Bearings

The elimination of turning shafts, shaft bearings and flexible contact leads minimizes mechanical wear. Double-break contacts of arc resistant alloys, *operating in air,* straightline vertical action and fast arc extinction add months of contact wear. Actual case histories of "once-a-minute interruption" duty have revealed little contact wear in a full year's operation.

Replacement Units

Compact design permits installation in a cubicle used for oil immersed units in existing starters. And, of course, the Type 256 Air Contactor is also available in Allis-Chalmers Type H Starters.

Call your nearby A-C representative or write for Bulletins 14B7303 and 14B6410. Allis-Chalmers, Milwaukee 1, Wisconsin.

A-3945

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

PLUGMOLD 2000

Adds MORE SALABILITY

to 368 home-development in Toledo . . .

because home owners WANT PLENTY of ELECTRICAL OUTLETS!

Builder Don Scholz, of Toledo's busy Scholz Construction Corporation, believes in giving prospective home-buyers the things they want most — he knows that they want *plenty of electrical outlets!* He saw PLUGMOLD 2000 — studied it, tested it — and standardized on Plugmold for the convenience outlet wiring in the 368 homes in his new Toledo development.

In these outstanding homes, Plugmold 2000 provides a duplex outlet every 30 inches in a continuous run. Plugmold 2000 also provides one "hot" and one switched outlet in *each receptacle*. Plugmold blends perfectly and inconspicuously into the baseboard.

Every builder wants a faster, easier, cheaper way to provide the multiple outlets that today's home buyers want . . . PLUGMOLD 2000 is IT!

PLUGMOLD did THIS in Toledo!

- provided 3 times as many outlets, at same cost as ordinary wiring — it's faster, easier, cheaper to install!
- provided complete flexibility for much more attractive room arrangements!
- greatly increased salability of the homes!

PLUGMOLD will DO the SAME for YOU!

Write today for the full Plugmold story and the new Plugmold 2000 book!

OK'd by the builder!

He likes the greater appeal Plugmold gives his homes . . . multiple outlets at cost of ordinary wiring . . . neat, attractive, inconspicuous appearance.

OK'd by the contractor!

He likes the ease and speed with which Plugmold can be installed . . . 3 times as many outlets, heavier service, and more circuiting without increasing wiring cost.

OK'd by the adequate Wiring Consultant!

He likes the efficient way Plugmold provides the outlets needed in today's home . . . Plugmold's safety features.

OK'd by the Home Buyer

. . . because there's always an outlet at hand for today's numerous devices and appliances . . . because multiple outlets in every room allow much more attractive arrangements of furniture!

WIREMOLD

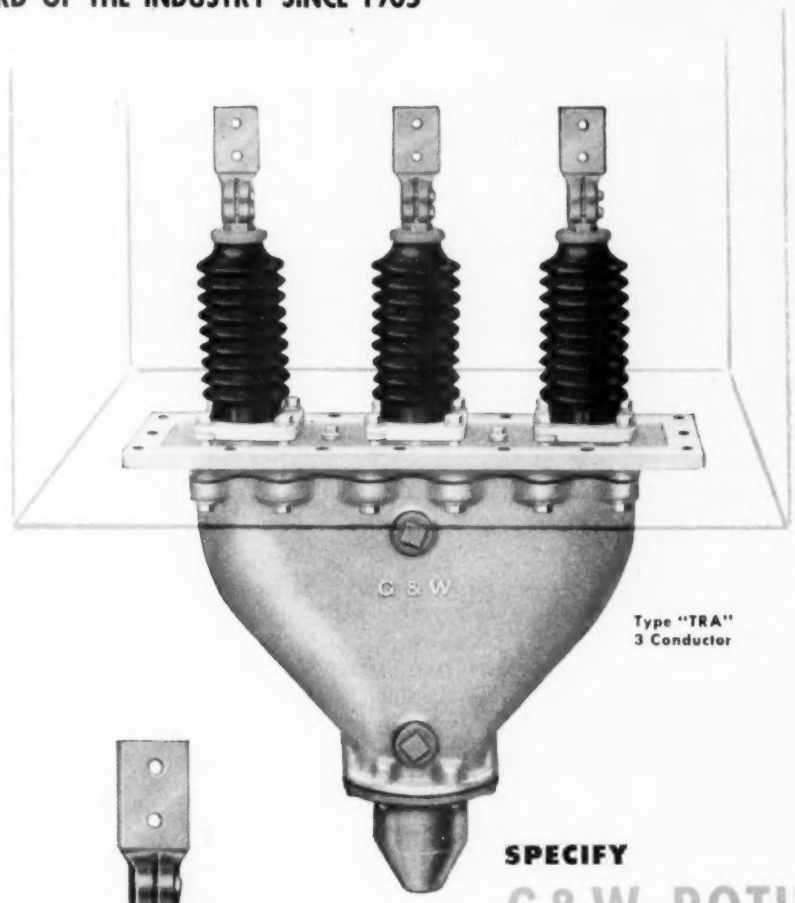
Makers of
PLUGMOLD—multi-outlet systems
WIREMOLD—electrical raceways
PANCAKE—overfloor raceways

THE WIREMOLD COMPANY • HARTFORD 10, CONN.

PROPER SEALING AND TERMINATING OF HIGH VOLTAGE CABLES

IS IMPORTANT . . . IT PAYS TO USE G & W POTHEADS . . .

THE STANDARD OF THE INDUSTRY SINCE 1905



Type "TRA"
3 Conductor

Type "TR"
Single Conductor

SPECIFY

G&W POTHEADS

for terminating cables in compartments

BECAUSE

G&W Potheads, in general, are more generously designed—With larger bore and thicker wall porcelains—
With sound air tight castings—With Resistoyl long life gaskets in special forms for permanently sealing joints—Accurately machined connector parts
and entrance fittings.

G&W ELECTRIC SPECIALTY CO.
7780 Dante Ave., Chicago 19, Ill.

Cable Terminating, Connecting and Sectionalizing Devices

Representatives in principal cities of U.S.A.
In Canada—Powerlite Devices Ltd., Toronto and Montreal

Introducing...

A NEW LINE OF AIR CIRCUIT BREAKERS

THREE NEW BREAKERS have been added to the line of General Electric Type AK breakers. This means that the AK line can be secured in interrupting ratings from 15,000 to 100,000 amperes.

SELECTIVE OPERATION up to full interrupting rating is now provided by triple-characteristic tripping devices which open the breaker to isolate a fault.

STORED-ENERGY CLOSING MECHANISM in new breakers gives safer, positive closing even against fault conditions. Closing is accomplished by energy stored in a sturdy closing spring even if control power is lost.

MULTIPLE CONTACTS give faster arc extinction, longer contact life and reduced maintenance.

INTERCHANGEABLE PARTS between breakers greatly reduce parts stocking problems. The main physical difference between breakers is the number of contact fingers which increases with rating.

COMPLETE NEW LINE OF DRAWOUT EQUIPMENT having whatever circuit pattern required, can be manufactured for shorter shipments by using standard circuit breaker compartments.

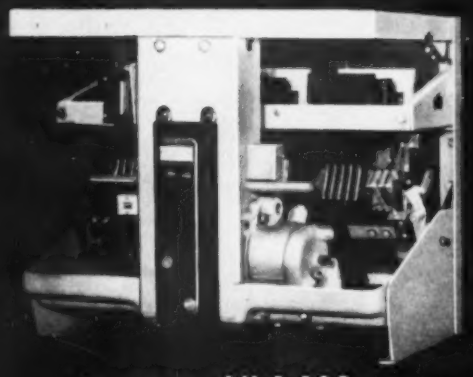
READILY ACCESSIBLE CURRENT TRANSFORMERS can be changed without disturbing bus connections.

INTEGRAL RACKING MECHANISM on removable unit cuts maintenance expenses.

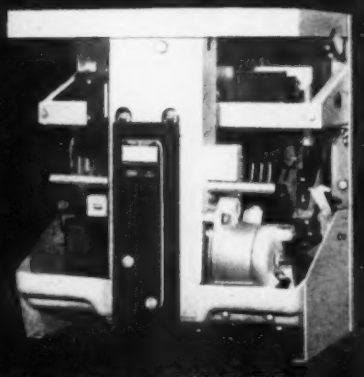
For full information, ask your local G-E sales representative for Bulletins GEA-5915 and GEA-5916 or write to General Electric Company, Schenectady 5, N. Y. 873-1

GENERAL ELECTRIC

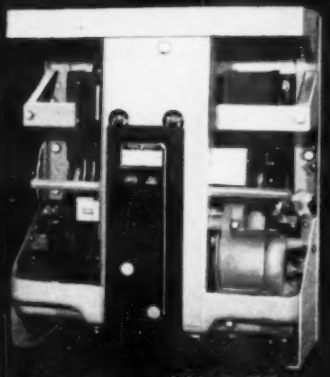
600 volts A-C 250 volts D-C



New Type **AK-1-100**
Rated: 4000 amps
100,000 amps interrupting



New Type **AK-1-75**
Rated: 3000 amps
75,000 amps interrupting



New Type **AK-1-50**
Rated: 1600 amps
50,000 amps interrupting

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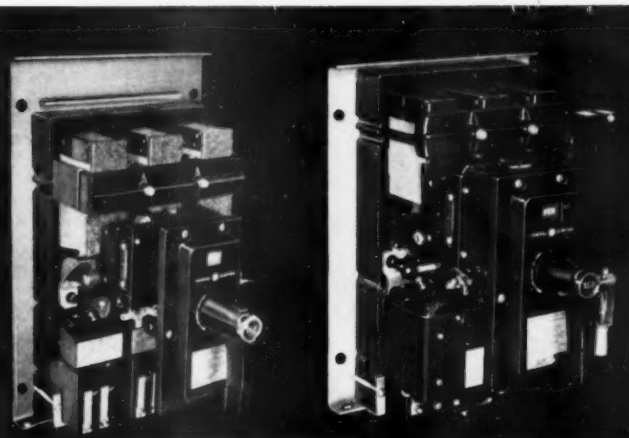
NOW, FOR THE FIRST TIME 30-cycle momentary ratings equal to full interrupting ratings permit selective operation under all conditions.

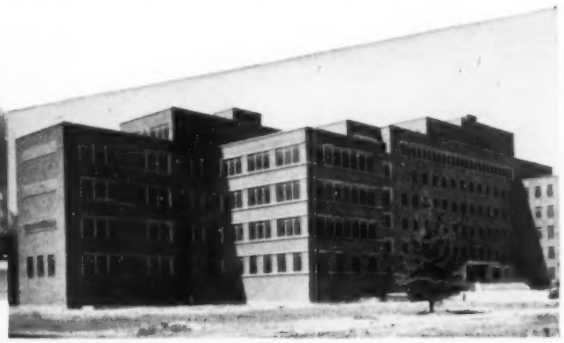


AK-1-25 and AK-1-15 Breakers, introduced in 1948, complete the line with ratings of 600 and 225 amps, interrupting ratings of 25,000 and 15,000 amps.

New line of drawout enclosures, designed for AK breakers. Now, for the first time, a line of breakers specifically designed for drawout equipments.

Give Your Hospital and Other Customers Modern Circuit Protection . . .

Southeast Florida Tuberculosis Hospital, Lantana, Florida, equipped with FA products. *Architects and Engineers*, Reynolds, Smith & Hill, Jacksonville, Florida; *Associate Architect*, Charles F Kuhm, Jacksonville, Florida.

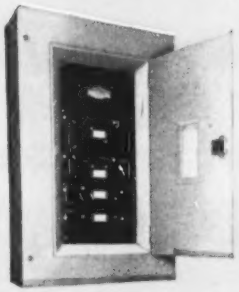


Buffalo State Hospital and Surgery Building — another FA equipped institution. *Architects*, York & Sawyer, New York; *Engineer*, Edward A. Sears, New York.

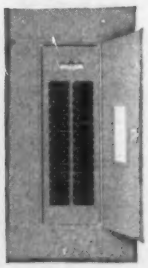
Install

ELECTRICAL PRODUCTS

SHUTLBRAK SWITCHBOARD



PULFUZSWITCH PANELBOARD



QP QUICKLAG P PANELBOARD

FA PRODUCTS are noted for their safety, efficiency, dependability, and economy of operation — vitally important factors in modern hospital and other types of construction.

A pioneer in the manufacture of products for the control and distribution of power and light, FA has specialized in the development of equipment that is modern in design, rugged in construction and will give long and trouble-free service — products that measure up fully to the requirements of the Underwriters' Laboratories, Inc., and the highest standards of the industry.

If you want to assure your hospital and other clients modern circuit protection, then install FA on all your jobs. Your nearest FA representative, listed in Sweet's, or your electrical wholesaler, will be glad to provide additional information on any or all FA products.

Frank Adam Electric Co.

P. O. BOX 357 • ST. LOUIS 3, MISSOURI

Our 62nd Year

Makers of: BUSDUCT • PANELBOARDS • SWITCHBOARDS • SERVICE EQUIPMENT • SAFETY SWITCHES • LOAD CENTERS • QUIKHETER

PROSPERITY IN THE USA: How Deeply in Debt Are We?

How prosperous *are* the people of the United States? Previous messages in this special series have answered this question in part by recording the progress—relatively slow progress—we have made in increasing both the income and the wealth per person in the USA.

This fourth and concluding piece of the special series deals with the extent to which our prosperity should be discounted because it has been accompanied by an increasing volume of debt. Many correspondents have suggested to us that an individual or a nation can temporarily increase prosperity by borrowing, but in so doing lives on both borrowed goods and borrowed time. Our purpose here is solely to throw light on the question of whether or not we are now in that unenviable position.

On January 1, 1953, the total debt of the United States government and of its citizens was $627 billion, as shown in the table below. On its face, a debt of this magnitude, which represents about $3,900 of debt for each person, suggests that we are heavily debt-ridden.

TOTAL DEBT – PUBLIC AND PRIVATE

Federal government debt	$267 billion
State and local debt	30 "
Private debt	
Corporations	195 "
Individuals	135 "
	$627 billion

The burden of our debts, however, does not depend simply on their size. It depends in much more decisive degree on our capacity to carry the load successfully. This capacity, in turn, is partly a matter of attitude, and attitudes defy objective measurement. A community that gets very jittery about its debts has less capacity to carry its burden successfully than one that does not. But the accurate measurement of jitters, present or prospective, still remains to be mastered.

Capacity to Carry the Debt Load

Nonetheless, it is possible to throw some light on our capacity to carry the debt burden by studying key economic elements that can be measured with some degree of accuracy. The following paragraphs indicate how some of these key economic elements stand.

Compared with our national income, the total volume of our debts, public and private, is still well below the level of 1929, when it proved to be too big for the good of the country. Our total debt is now 113% greater than the national income whereas in 1929 it was 146% greater.

There are several other cheering facts about our debts. One is a sharp decline in interest rates which makes the cost of carrying our debts relatively much less than it was in 1929. It took 8% of our total national income to carry our debts in 1929; it takes only about 5% of the income today.

More Cheering Facts

We also have much more ready cash now than in 1929. Today individuals and corporations hold a total of $269 billion in cash or its equivalent which is almost twice as much as the portion of private short-term debt (about $140 billion) that is subject to sudden demand for payment.

Many students of the subject cite the relatively low cost of carrying our debts and the large volume of cash on hand, and reach the comfortable conclusion that our debt burden is nothing to worry about. In further support of this view they emphasize the fact that no important part of our debt is owed abroad. Hence, they reason there is not the danger, so conspicuous in Britain since the end of World War II, that our economy will be upset by the necessity of making heavy debt payments to other countries.

Some Dangers of Present Debt

However, the nature of our debts presents dangers that it would be foolish to ignore. This is true of both the debt of $267 billion owed by the federal government to its citizens and the $330 billion in private debts owed by some citizens and corporations to others.

Public debt can be a dangerous kind of debt because government has the power to print money or to create its equivalent by expanding bank credit. Of the $215 billion that the federal government borrowed during World War II, over $90 billion was borrowed from banks. This was the largest single contributor to the inflation of prices that since the war has robbed the dollar of about half of its purchasing power, and thereby robbed the buyers of government bonds of about half the purchasing power these bonds were supposed to represent.

If, as is quite possible, a new emergency should again require the federal government to borrow heavily while its debt remains so high, it is doubtful that the public would be avid to buy its bonds. Hence, the government might again be forced to resort to the inflationary process of relying on bank credit.

Private debts can be dangerous if the people take on new debts more rapidly than is justified by the growth of business or by their ability to repay. Last year bank loans were increased by the imposing sum of about $6½ billion, which represents an increase of about 11% in total loans outstanding. This is almost twice as much as the increase in the volume of business over the same period. Installment credit for consumers increased by $3 billion last year, again an increase in debt about twice as great as the increase in business volume in the fields where the credit was used. It is also the fastest rate of such growth in our history.

Constructive Use of Credit

So long as the expansion of credit does no more than keep pace with expansion in the volume of business, the expansion is constructive. Also, when credit is expanded to acquire resources and equipment that will enlarge the volume of business a little later, that use is clearly constructive. But when private credit expansion begins to run ahead of business growth, it is time for us to be heads up. Such credit expansion courts price inflation. It also creates a forced draft under business so that, if credit is cut off, there may be a painful drop.

To give a summary answer to the question: *Is the level of debt in the United States a danger to our prosperity?* — the answer seems to be, "Not at the moment." We owe nothing abroad. The interest burden on present debt is relatively small, and we appear to have the resources to handle the short-term debt. Yet both the total amount of debt and the recent rapid increase in total private debt, especially the latter, are enough to signal for caution. We need restraint on the part of business and consumers to avoid expanding private borrowing at an excessive rate. The federal debt needs to be reduced and put in more manageable form. If these things are done, we can proceed to build a sound prosperity.

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These bearings last longer than life . . . grease life

G-E TRI-CLAD MOTORS LAST LONGER

REG. U.S. PAT. OFF.

ALL GREASE LIFE IS LIMITED. The best known greases dry out in time. This may be six months, seven years, or longer, depending on motor application.

SOME MOTORS ARE USELESS WHEN GREASE DRIES OUT. They can't be regreased, you lose production time . . . because your maintenance man is "sealed out."

BUT GREASE LIFE NEED NOT LIMIT MOTOR LIFE. Tri-Clad motors give long life without relubrication, plus provision for adding new grease when necessary.

ADDED GREASE IS USEFUL GREASE. Relubrication puts fresh grease in storage in bearing housing . . . as motor operates, grease oils migrate to bearing as needed.

TRI-CLAD MOTOR BEARING IS EASIEST TO REGREASE. Do it on the job, with motor running . . . no dismantling . . . no trip to a service shop.

TRI-CLAD MOTOR BEARING IS BETTER PROTECTED. Completely enclosed housing has *longer seals* to keep dirt out, *larger grease supply*, and *scientific design* for continual grease migration.

THIS PRACTICAL BEARING DESIGN is one more reason why G-E Tri-Clad motors give better service . . . added life. Order through your nearby G-E Apparatus Sales Office or authorized G-E agent or distributor. General Electric Company, Schenectady 5, N. Y.

752-18

You can put your confidence in—

GENERAL ELECTRIC

EASY TO INSTALL, G-E L-69 FLOODLIGHTS DOUBLE USE OF RECREATION AREA.

G-E L-69 floodlights for lower installation costs

EASY INSTALLATION. You save money by saving time when you install competitively priced G-E L-69 1500W Floodlights. From the simple two-bolt mounting to the convenient beam sight for fast daylight aiming, the lightweight G-E L-69 is designed so that it will cut your costs by simplifying your installation. On many installations, the floodlight can even be aimed while the pole is on the ground, with easy to read horizontal and vertical degree scales.

And with the G-E L-69, you do a quality lighting job that soon pays off in more lighting business for you.

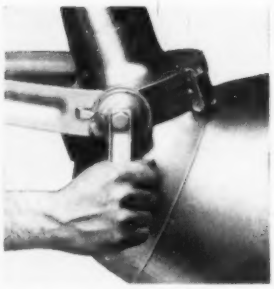
ECONOMICAL MAINTENANCE. Built in wrench type handle on the G-E L-69 completely eliminates the need for tools. Both relamping and cleaning are fast and easy, and the G-E L-69 delivers more light per unit, more light per watt, than any other comparable lighting unit obtainable anywhere.

PROMPT DELIVERY. You can get the G-E L-69 right out of stock at shipping points throughout the country. Whatever your lighting requirements, there's a light in G.E.'s complete and comprehensive line to precisely fit your particular needs. And if you need help, you can get it from G.E.'s staff of lighting specialists.

USEFUL INFORMATION is yours for the asking. NEMA approved floodlighting plans for all sports are contained in GET-1284; effective industrial uses are explained in GEA-3640D; and Bulletins GEC-533B and GEC-919 give complete details on the L-69 sports and area floodlight. Just write Section 451-179, General Electric Co., Schenectady 5, New York.

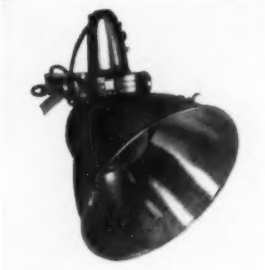
You can put your confidence in—

GENERAL ELECTRIC

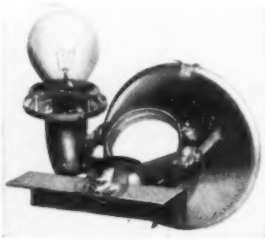


NO TOOLS required for initial positioning or maintenance, with built in wrench-type handle. Large area clamping action holds against vibration.

EASY AIMING possible even during daylight with G-E L-69's convenient beam sight . . . puts the light in the right place, saves time.



NO BREAKAGE with spun-on, impact resisting tempered plate glass, which won't break if struck by ball, and keeps out water, dirt, insects.



EASY CLEANING and relamping! Just flick hand toggle latches, clamp socket housing to trunnion bracket. Hands are free to service light.

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CAA Approved

for Airport Lighting

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Cables for 3,000 volt and 5,000 volt to the same specification can be furnished.

Tens of millions of feet have been giving outstanding trouble-free service for many years. Write for bulletins No. 491 and No. 492.

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WIRE & CABLE

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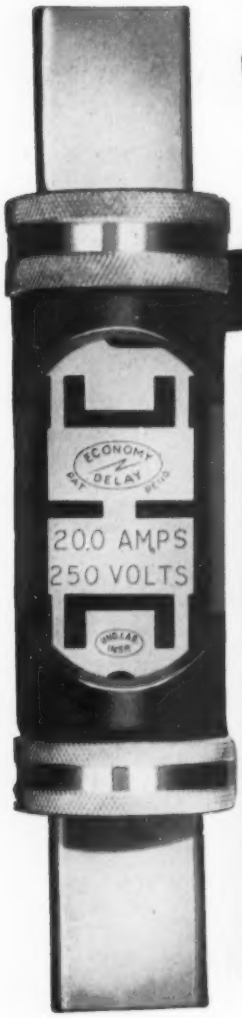
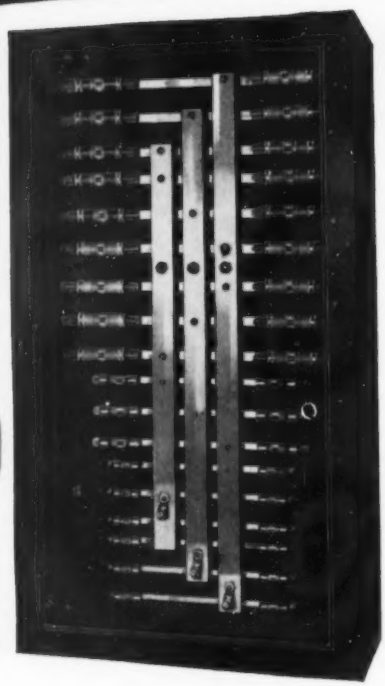
TRENTON, N. J.

OVER 70 YEARS EXPERIENCE

for FUSE ECONOMY... use ECONOMY FUSES





this SURE Protection... in ALL Standard Capacities

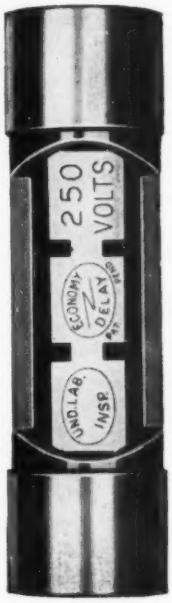
Give all your circuits the safe and saving protection of "ECONOMY DE-LAY" Renewable Fuses.

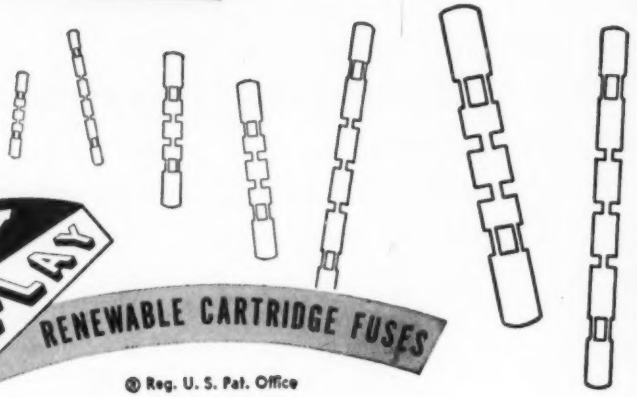
Then whenever you have an electric current "blow", you instantly restore the fuse to its original efficiency by simply inserting an inexpensive "ECONOMY DE-LAY" Renewal Link *in the same cartridge.*

Takes only a minute or two; costs only a few cents!—And you Conserve Precious Brass and Copper.

Your Electrical Wholesaler has "ECONOMY DE-LAY" Renewable Fuses and Renewal Links in stock.

Ask for the Economy Catalog and Price List.





ECONOMY DE-LAY RENEWABLE CARTRIDGE FUSES

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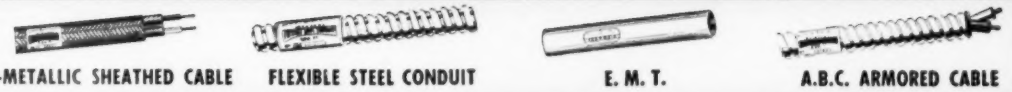

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WHAT *Life-Line* REALLY DELIVERS IS MORE SERVICE... LESS SERVICING

What *Life-Line* really delivers is

...more service
...less servicing

"We can't afford equipment breakdowns. We manufacture ice cream making machinery and operate franchise stores throughout the country. Store operators know very little about maintenance. We *must* select equipment that assures trouble-free performance with minimum maintenance. That's what Life-Lines give us. That's why we standardize on them."

The above statement by the chief engineer of an eastern manufacturing plant tells the Life-Line story best. Summed up it means more service, less servicing, with Life-Lines.

Take the Life-Linestarter, for example. Contacts last longer because exclusive "De-ion®" arc extinction snuffs out arcs fast . . . reduces contact pitting. Simple seesaw balance of clapper prevents accidental opening; kickout spring prevents accidental closing. Compare with any other starter and see why Life-Linestarters offer *more service with less servicing.*

The Life-Line motor's advance design completely eliminates periodic lubrication. Pre-lubricated factory-sealed ball bearings need no greasing attention. Further, steel construction cuts breakage from rough usage. Superior insulation and winding techniques lengthen electrical life. On-the-job reports of a half million Life-Lines show why you get more service with less servicing.

It costs no more to get Life-Line performance. Ask your Westinghouse representative for details or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna.

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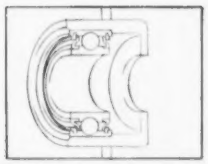
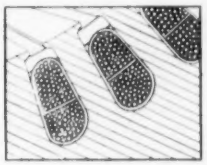
YOU CAN BE **SURE**...IF IT'S

Westinghouse

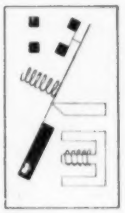


MOTOR

Needs no lubrication. Pre-lubricated factory-sealed bearings eliminate troubles due to under or overlubrication, dust and dirt.

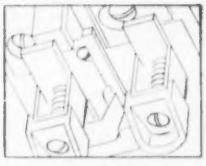


Cuts winding burnouts. Pear-shaped slot design eliminates pockets. No corner voids remain to collect dirt, moisture.



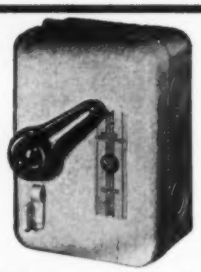
STARTER

Never Jams. No sliding surfaces to wear—no sticking—no jamming—nothing to wear or replace.



Never needs filing. Silver-to-silver contacts eliminate filing. Discolored silver maintains high conductivity.

General Purpose . . . one, two or three pole



Dust Tight . . . one, two or three pole

Explosion-proof (Class I, Group D) . . . one, two or three pole

GROWING in usage all the time . . .

. . . BECAUSE THESE CIRCUIT BREAKERS ARE *HYDRAULIC-MAGNETIC*

ONE FACT . . . that HEINEMANN Circuit Breakers are unaffected by ambient temperature . . . is the greatest reason for the growing demand. Time delay for starting inrush and momentary overloads is provided by a hydraulic-magnetic operating principle . . . eliminating thermal elements, thus also eliminating the need for de-rating to compensate for temperature change. HEINEMANN Circuit Breakers are unaffected by the summer heat or winter cold . . . by adjacent heating pipes or open windows.

No need for de-rating also, in effect, increases your power capacity because you can always carry the full safe rated load of the wires.

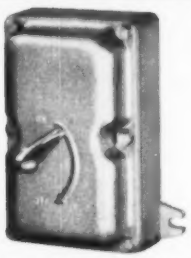
All these enclosure types are available for the growing business in the HEINEMANN Circuit Breaker line.

Send for literature. HEINEMANN ELECTRIC CO., 132 Plum Street, Trenton 2, New Jersey.

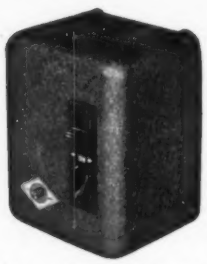
don't use heat . . . *USE POWER*

HEINEMANN *Circuit Breakers*

HEINEMANN Circuit Breakers. One, two and three pole. 10 milliamps to 100 amperes.



Explosion-proof (Class I, Group D) . . . one, two or three pole



Safelet . . . also available with pilot light and receptacle

Indoor Service Center

Auxiliary Explosion-proof Housing . . . one or two circuit breakers

Outdoor Service Equipment . . . up to 100 amperes

Temporary Service Unit

Century's complete line of electric motors permits selection of a motor with the right characteristics to get all the performance built into the machines you buy.

Hundreds of kinds and types are available to meet many different power requirements . . . and these motors are available in 5 different types of frames to assure satisfactory performance in any kind of surrounding atmosphere. Choose from open type, drip proof, splash proof, totally enclosed fan cooled, and explosion proof frames.

Century motors are available in sizes from ⅛ to 400 horsepower—single phase, polyphase and direct current.
Specify Century motors for all your electric power requirements.

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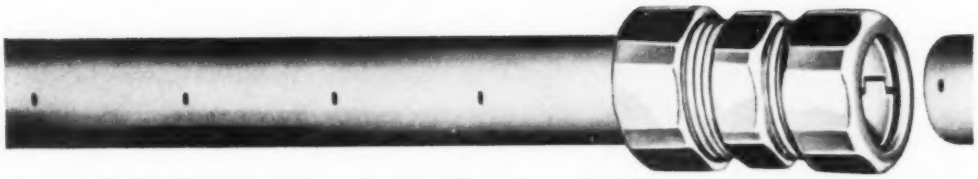
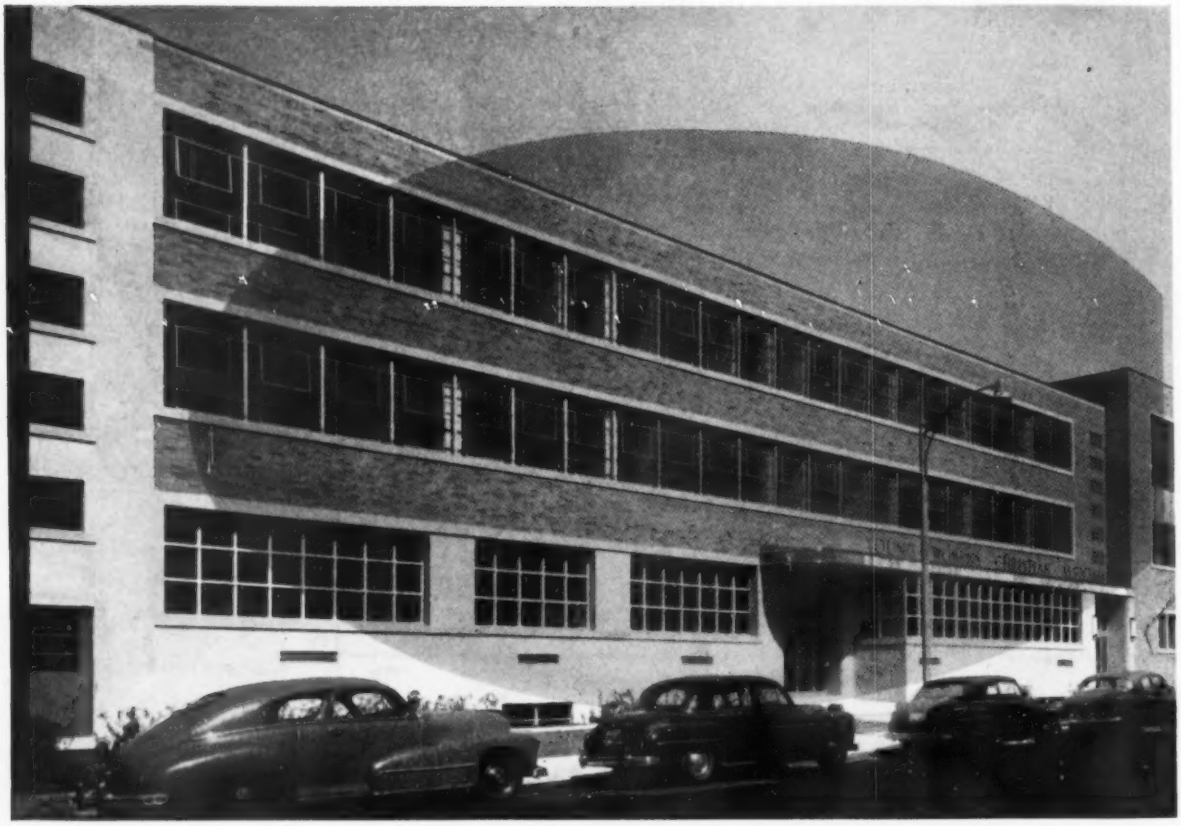
Good for years of service . . .

WITH WIRES IN

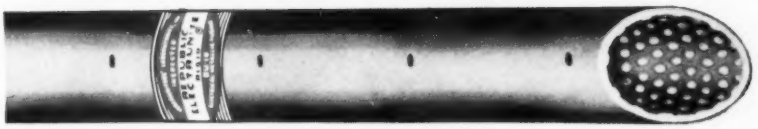
REPUBLIC ELECTRUNITE

The "INCH-MARKED®" E.M.T.





Flat against the wall and saddled around a column . . . Republic ELECTRUNITE *E.M.T. is easy to install because it's unnecessary to turn the whole run.*



Young Women's Christian Association, Buffalo, New York.

Architects: Duane Lyman & Associates, Buffalo

General Contractors: Siegfried Construction Co., Buffalo

Electrical Contractors: Stroh Electrical Construction Co., Buffalo

Consulting Engineer: Edwin Burrows, Buffalo

● In the new Buffalo Y.W.C.A. building, the dependability and safety of electrical circuits is protected by thousands of feet of Republic ELECTRUNITE E.M.T. (electrical metallic tubing).

The exclusive "Inch-Marked®" feature of Republic ELECTRUNITE E.M.T. makes it easy for journeymen to accurately locate bending and cutting points. Connections are quickly made moisture-tight with many available types of couplings and connectors and it is unnecessary to turn whole runs. The exclusive *inside-knurled* surface cuts down the effort of pulling wires through Republic ELECTRUNITE E.M.T.

On practically all construction and rewiring jobs . . . concealed, exposed, or concrete-slab . . . there will be fewer headaches if you order Republic ELECTRUNITE . . . the only "Inch-Marked" E.M.T.

STEEL AND TUBES DIVISION
REPUBLIC STEEL CORPORATION
212 EAST 131st STREET • CLEVELAND 8, OHIO

Republic
REPUBLIC STEEL
ELECTRUNITE E.M.T.

dependable McGILL® lamp guards outlast all others

Here are two of the many McGill portable lamp guards that will withstand the hard wear and abuse of heavy industrial use. McGill 7000 and 650 series lamp guards last many times longer than ordinary guards because of exclusive design, heavier and better quality material and superior workmanship.

These models have pliable molded rubber handles and extra heavy steel wire cages that are electrically welded for strength and zinc plated with chrome finish to remain clean and bright for years. Sockets are 660 watt 250 volt, either plain or waterproof.

Such extras as cord seals, larger hooks and No-Rol ears to prevent cage rolling add to the safety and convenience of using dependable McGill portable lamp guards.

Model 7000-SR with Rubber Handle, Reflector and Levolier Switch.

Model 650-SR with Curved Rubber Handle. This exclusive handle design permits hanging portable cage down so that light is free from any possible handle obstruction.

all are McGILL® quality

Model 5000-SR
Convenience Outlet, Reflector and Switch.

Model 5025-SLRG
Grounded Concentrating Lens.

Model 3006
Vaporproof Guard.

Model 5500-SRG
Grounded, No Outlet, Closed End Cage.

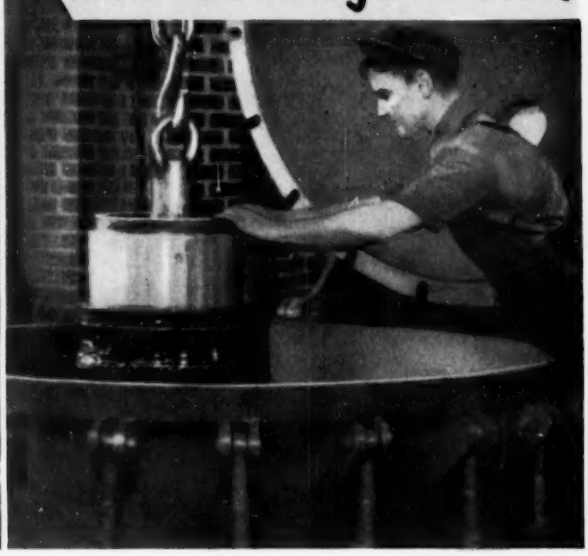
Send for the new McGill Catalog No. 49-A describing the complete line of McGill Lamp Guards, Sockets and Switches.

McGILL MANUFACTURING COMPANY, INC.
450 N. Campbell St., Valparaiso, Indiana

McGILL®
electrical specialties

Need coated insulation?

...or insulating varnishes?



FOR EVERY REWIND JOB... there's a quality Irvington Insulation

For motor rewinds that really stand up, look into the comprehensive Irvington line of coated insulations and insulating varnishes.

OUTSTANDING IRVINGTON PRODUCTS INCLUDE:

Class "H" Insulations. Silicone Resin-impregnated Fiberglas*. Silicone Rubber-coated Fiberglas. Silicone Rubber-coated Fiberglas Tubing. Silicone Resin-coated Asbestos. Silicone Resin-saturated Asbestos. Teflon**-coated Fiberglas. Silastic*** Tape.

Class "B" Insulations. Varnished Fiberglas. Varnished Asbestos.

Class "A" Insulations. Varnished Cambric, paper, nylon, Orlon, silk, rayon. Irv-O-Slot slot insulation.

Insulating Varnishes — baking and air drying types. Oilproofing enamels.

Plastic Tubing, Tapes and Wire Markers.

*® Owens-Corning Fiberglas Corp. **® Du Pont ***® Dow-Corning

Look to
IRVINGTON
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INSULATING VARNISHES
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VARNISHED PAPER
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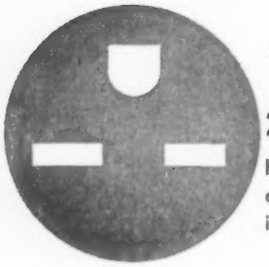
New Safety

THE ANSWER IS BRYANT

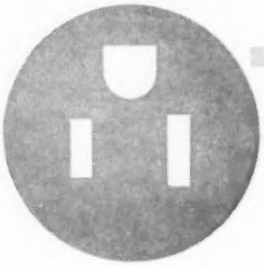
A Complete Line of Quality Grounding Devices

In the interest of personal and equipment safety, two distinctive lines of Bryant grounding devices are available for 125 volt and 250 volt applications. Through proper use of these devices, it is impossible to plug 125 volt appliances into 250 volt outlets or 250 volt appliances into 125 volt outlets. Here's why:



250 VOLT DEVICES

have power blades and slots arranged in *tandem.*

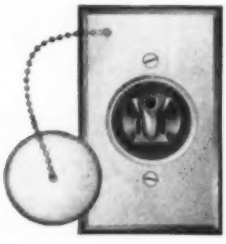


125 VOLT DEVICES

have power blades and slots arranged in *parallel.*

FLUSH MOUNTING OUTLET

NO. 5662 Duplex, Brown Plastic "Break-off" terminals for Switch control of one outlet. Takes standard duplex outlet plate.



WEATHERPROOF OUTLET

NO. 5260

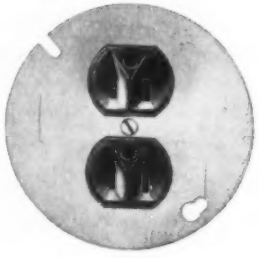
Plate and cover finished to resist corrosion

CONNECTOR BODIES

NO. 5669 Brown Plastic, Armored with cord grip.

NO. 5669 for .296 to .562 inch cord (19/64 to 9/16)

NO. 5670 for .406 to .625 inch cord (13/32 to 5/8)



BOX MOUNTING OUTLETS

On 4-inch covers finished to resist corrosion

NO. 5282 Duplex, Brown

NO. 5281 Single, Brown

CAP

NO. 5674

Black Rubber

Cord Hole .312 to .468 inch (5/16 to 15/32)

CONVENIENCE OUTLETS

Single, Brown Plastic

NO. 5261

Takes standard Single outlet plate

J-99886

Additional devices available in both lines
Listed by Underwriters' Laboratories, Inc.

THE BRYANT ELECTRIC COMPANY
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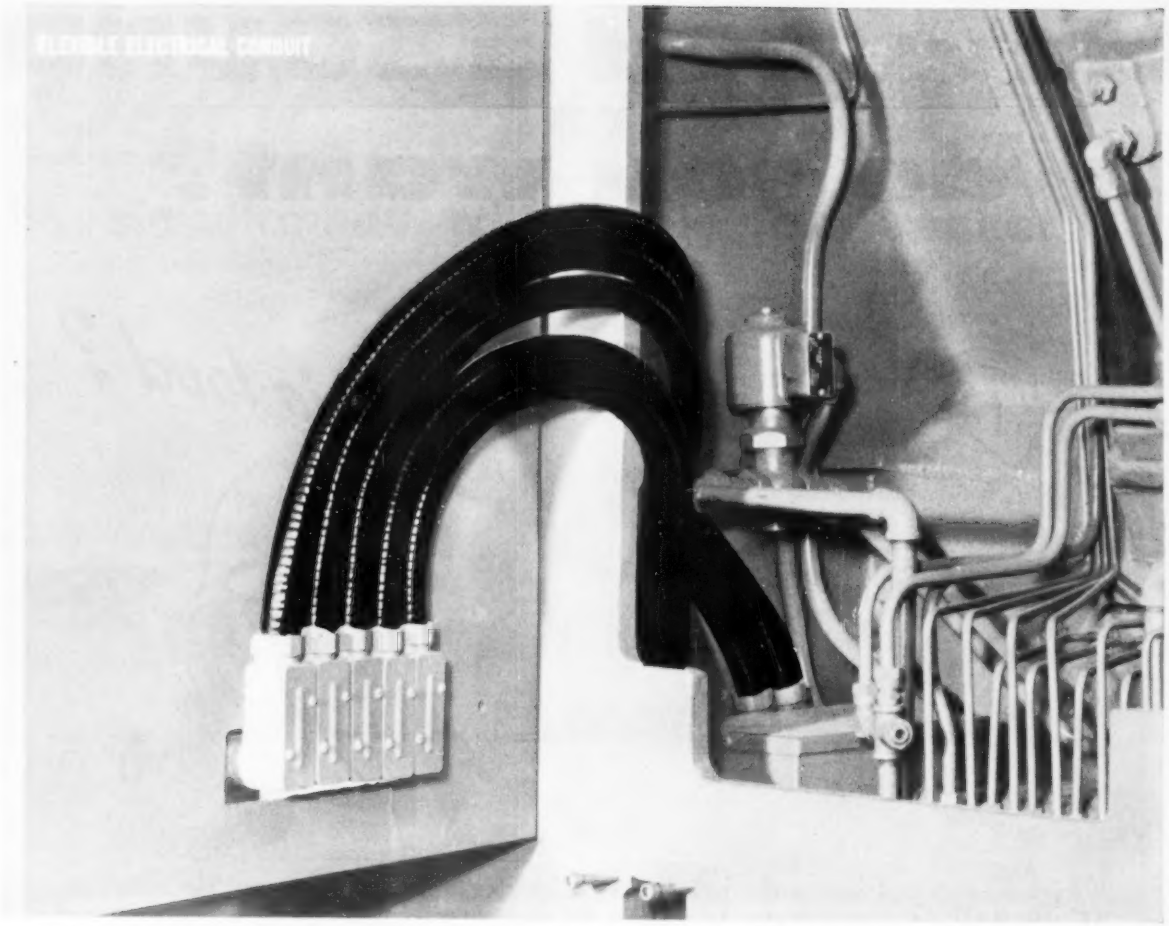
Specify Bryant from Your Electrical Distributor

BRYANT
SUPERIOR WIRING DEVICES



Sharp bends are easily taken by SEALTITE, as shown in this back view of a Gisholt Crankshaft Superfinishing Machine.

SEALTITE: wiring's best flexible protector

Here this liquid-tight conduit protects against abrasion and oils, allows movement.

Shown above is one way Gisholt Machine Co. uses flexible *and* liquid-tight SEALTITE* on their Superfinishing Machines. Here SEALTITE permits ready opening and closing of the rear panel, resists abrasion and keeps out oil, grease, water, fumes and dirt.

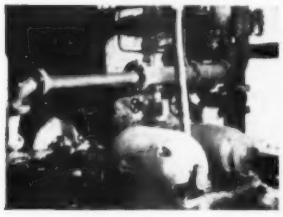
New, improved SEALTITE (Type UA) provides the best all-around protection available today in a flexible conduit. That's why Underwriters' Laboratories, Inc. have given it their coveted seal of approval. Type UA may be used in wet locations and where exposed to mineral oils (up to 60 C). A JIC-approved SEALTITE (Type EF), primarily for machine tools and comparable applications, is also available. It can be bent to small radii and installed easily in cramped quarters.

Electrical Supply Houses stock SEALTITE. Buy in long random lengths; then cut without waste. For descriptive booklets write: *The American Brass Company, American Metal Hose Branch, Waterbury 20, Connecticut. In Canada: The Canadian Fairbanks-Morse Company, Ltd.* AB196

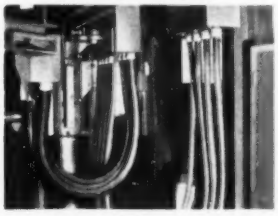
*Trademark

for flexible, liquid-tight electrical conduit specify SEALTITE an ANACONDA® product

WET LOCATIONS

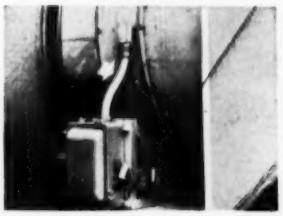


MOVING CONNECTIONS



OUTDOOR PROTECTION

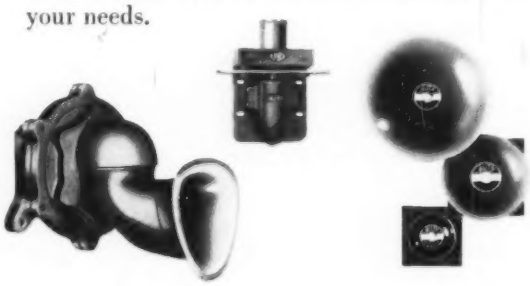
MISALIGNMENT



How loud a SOUND do you want?

Whichever sound you want, AUTH'S AUDIBLE SIGNALS can fill your bill. There are nonpareil Powerbels for any heavy duty signaling or alarm jobs, where fast-installing, powerful-sounding vibrating or single stroke bells are needed . . . and there are midget buzzers smaller than your belt buckle — precision built, as smooth and soft-sounding to the ear as the purr of a kitten . . . as well as many other AUTH bells, buzzers, chimes, horns and sirens awaiting your selection. You can get the signal you want from AUTH!

Remember, too, that AUTH is your company when you need ***systems*** to signal and communicate, keep correct time, and protect lives and property from fire in schools, hospitals, housing projects and industry. The experience derived from 60 years of research and progressive manufacturing methods in this field is available to you without obligation, if you desire technical help or guidance. Literature, too, is available — please write the Auth Electric Company, Inc., 34-20 Forty-fifth Street, Long Island City 1, New York, and tell us your needs.



Whatever your problem, place your trust in an experienced company; place your faith in a specialist; place your order with AUTH.

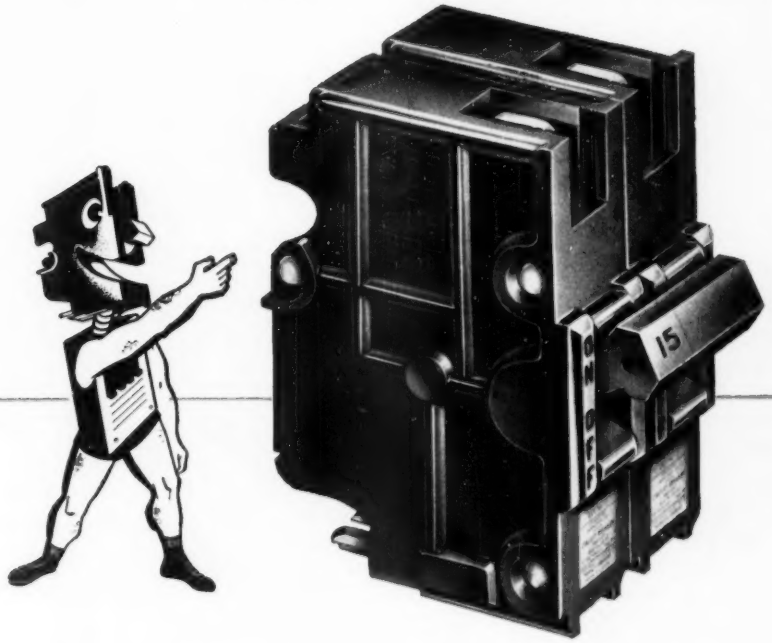
SINCE 1892

AUTH

FOREMOST IN THE DESIGN AND MANUFACTURE OF ELECTRICAL SIGNALING, COMMUNICATION AND PROTECTIVE EQUIPMENT

Only Stab-lok®

has simultaneous trip double pole breakers...



THERE ARE NO HANDLE TIES on Stab-lok double pole breakers. These are 100% simultaneous trip breakers ...it's impossible to trip one breaker without tripping the other. And Stab-lok double pole breakers not only meet the most rigid requirements, they're twice as wide as single pole Stab-loks and instantly interchangeable. Both breakers come in a standard 15 to 50 amp. range.

Stab-lok is the only popular priced breaker whose dependability has been proved on millions of installations. In addition, Stab-lok is today's most modern and flexible circuit protection *system*...a system with a full package of advantages nowhere else obtainable . . . including lowest installed cost. Write for the full Stab-lok story...and order Stab-loks from your distributor.

And only *Stab-lok* has all these extra features

1. Full size; metal where it counts; fewer, more rugged parts.
2. Proved on millions of installations.
3. A complete line of enclosures.
4. Minimum installation costs.
5. Unique 4-way stabs—easiest; safest; automatically locked.
6. Combination flush-surface enclosures.

FEDERAL ELECTRIC PRODUCTS COMPANY 50 Paris Street, Newark 5, New Jersey

Federal Noark products: Stab-lok Circuit Breakers, Motor Controls, Safety Switches, Service Equipment, Industrial Circuit Breakers, Panelboards, Switchboards, Control Centers, Bus Duct ★ Sales offices in principal cities.

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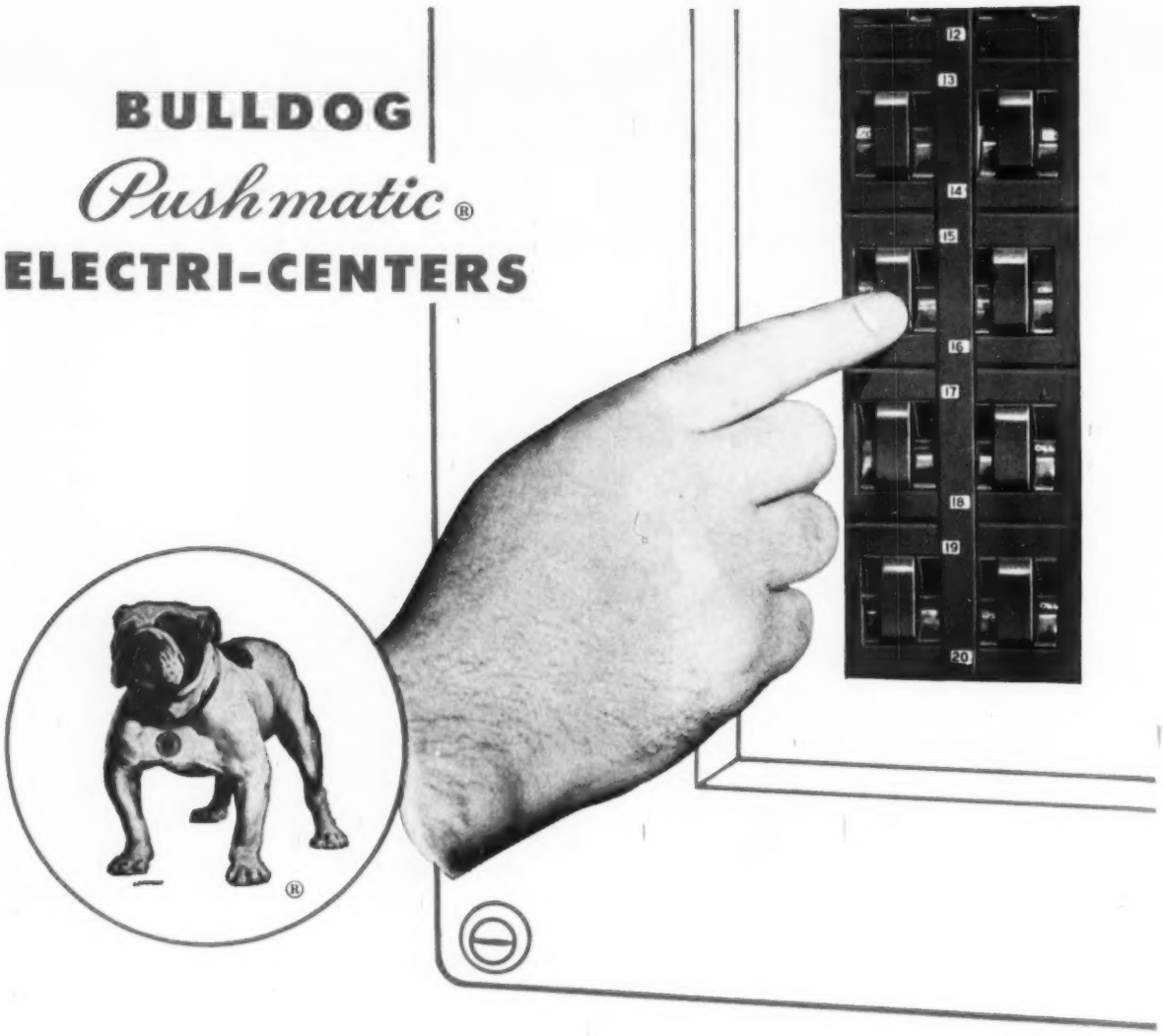
BULLDOG

Pushmatic®

ELECTRI-CENTERS



Thoroughbreds on Guard!

The clean, neat exterior of BullDog Pushmatic Electri-Centers is truly indicative of their thoroughbred quality and safe, dependable operation.

Only Pushmatics give you simple-to-operate push-button control. On guard over electrical equipment like a row of sentinels, Pushmatics let you easily see whether the circuit is on or off. When a short or overload occurs, the push-button snaps forward, automatically breaking the circuit, and word "OFF" appears. Once the trouble has been remedied, simply *push the button*, and service is instantly restored.

BullDog Pushmatic Electri-Centers are available in sizes from 2 to 42 circuits, to fill every industrial, commercial or home requirement. Write today for free Bulletin PM-355 giving complete information. BullDog Electric Products Company, Dept. EC33, Detroit 32, Michigan.

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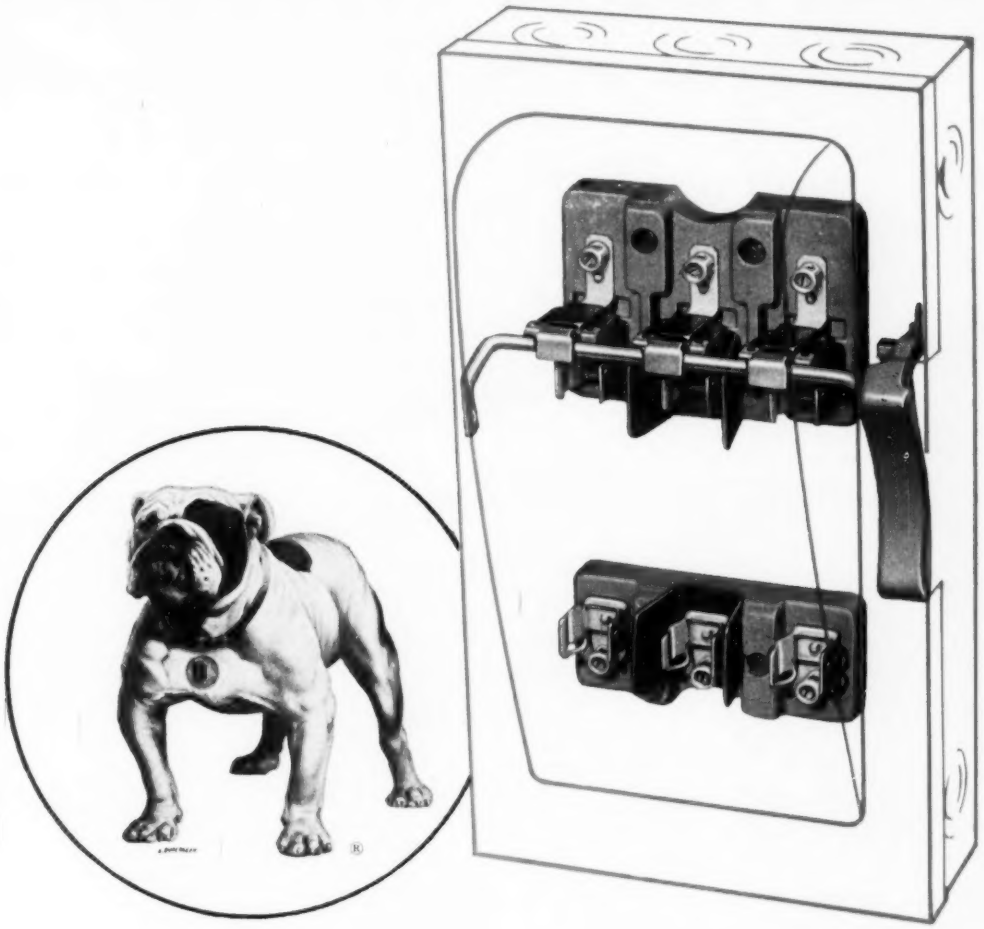
BULLDOG

ELECTRIC PRODUCTS COMPANY

BULLDOG VACU-BREAK SAFETY SWITCH



It's a Thoroughbred--and Looks it!

A THOROUGHBRED — whether a dog or a safety switch — always looks the part because it's better on all points. In the BullDog Vacu-Break Switch — the thoroughbred of safety switches — the trim, functional exterior is the direct result of fine engineering and design of interior components.

LOOK INSIDE . . . and see how BullDog's exclusive Vacu-Break with its practical, compact design, gives you both extra safety and clean-lined tailoring. See how all parts and assemblies are engineered as a perfectly co-ordinated unit to assure maximum efficiency, safety and economy.

WRITE TODAY FOR FREE Bulletin B-250, and get complete details on BullDog Vacu-Break Safety Switches. BullDog Electric Products Company, Dept. EC33, Detroit 32, Michigan.

BULLDOG
ELECTRIC PRODUCTS COMPANY

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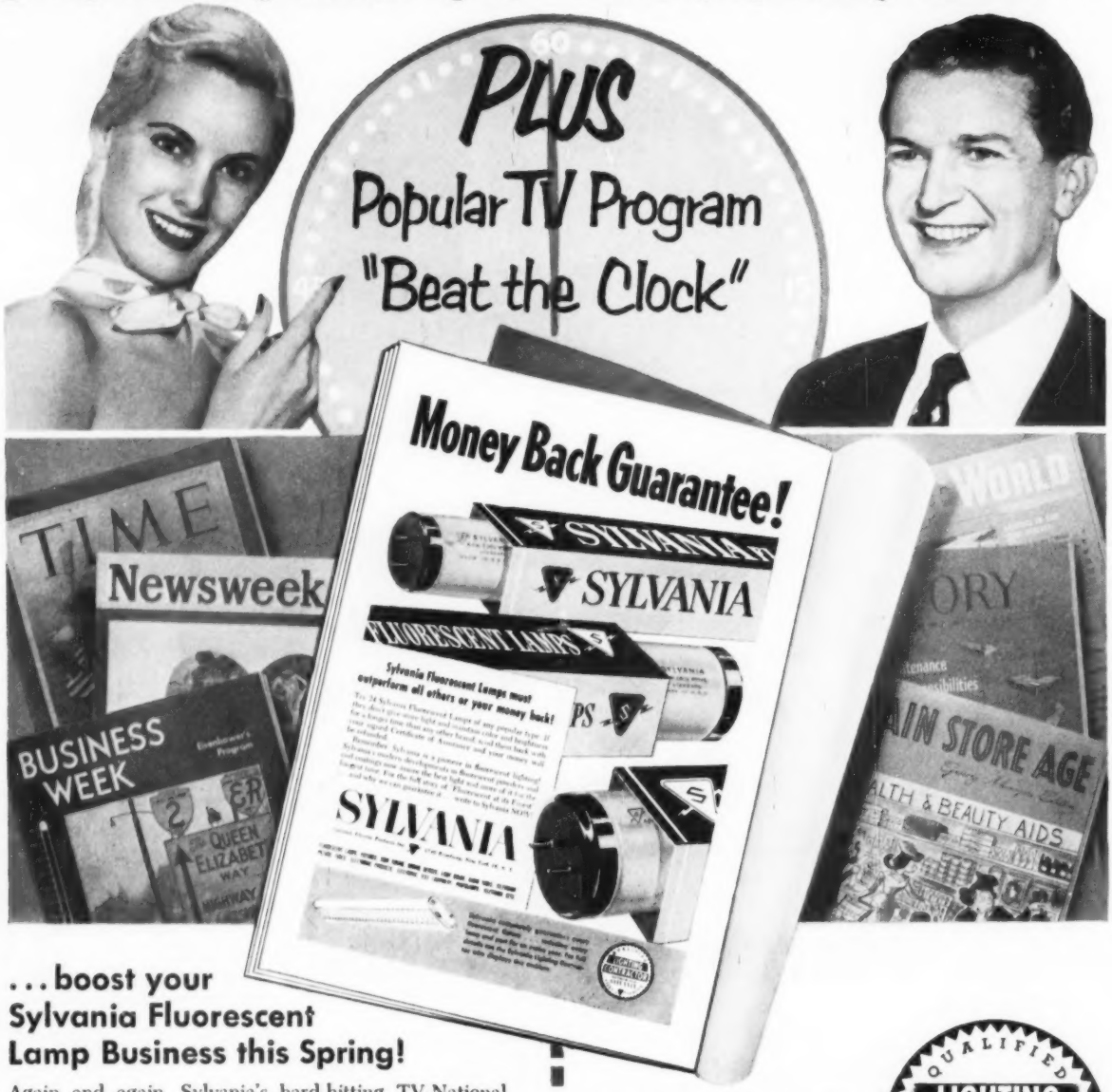
FULL PAGE NATIONAL ADS...



. . . boost your Sylvania Fluorescent Lamp Business this Spring!

Again and again, Sylvania's hard-hitting TV-National Magazine campaign pre-sells Sylvania Fluorescent Lighting for *you*.

This coordinated campaign packs plenty of sock and follow-through. Millions of prospects will see and hear Sylvania's famous *better-performance guarantee* on the weekly "Beat the Clock" TV show over a nation-wide 42-station CBS hook-up.

Millions also will read this same amazing, money-back offer in full-page ads in *Time, Newsweek, Business Week,* as well as in *Factory Management and Maintenance, Textile World, Chain Store Age and other leading business publications.*

Don't pass up this profitable opportunity! Make sure NOW that you have plenty of Sylvania longer-lasting, guaranteed fluorescent lamps in stock. For further information, write today to: Sylvania Electric Products Inc., Dept. 3L-2103, 1740 Broadway, New York 19, N. Y.

Display this emblem prominently on your windows and trucks. It identifies you as the local Qualified Lighting Contractor with guaranteed Sylvania Fluorescent Lamps.

QUALIFIED LIGHTING CONTRACTOR AUTHORIZED SYLVANIA SALES SERVICE

SYLVANIA

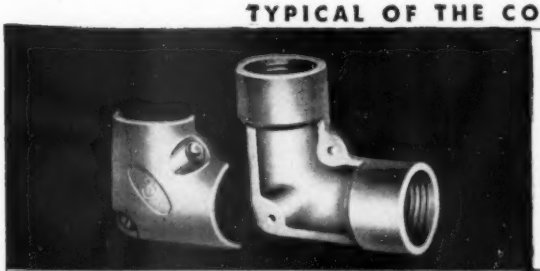
FLUORESCENT LAMPS, FIXTURES, SIGN TUBING, WIRING DEVICES; LIGHT BULBS; RADIO TUBES; TELEVISION PICTURE TUBES; ELECTRONIC PRODUCTS; ELECTRONIC TEST EQUIPMENT; PHOTOLAMPS; TELEVISION SETS

FOR CORNER PULL-IN ELBOWS, 3-PIECE CONDUIT COUPLINGS, PIPE STRAPS—CLAMP BACKS—NEST BACKS

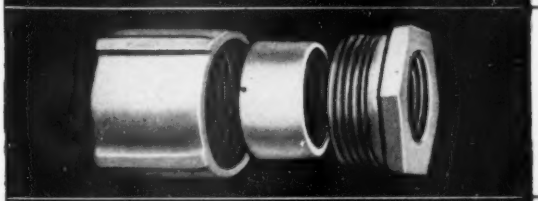
GEDNEY *ALWAYS!*

NATURALLY you want to cut installation time and costs. And you'll do it easily with Gedney Fittings, for these fittings are accurately machined and threaded, smooth finished, individually inspected to ensure top quality. What's more, Gedney Fittings are made of unbreakable malleable iron. For best profits, order Gedney always!

TYPICAL OF THE COMPLETE GEDNEY LINE ARE:



Corner Pull-In Elbows in ½", ¾" and 1" sizes. Ideal for space-saving, machine wiring, easy wire pulling. Cadmium plated.



3-Piece Conduit Couplings in a large range of sizes from ½" to 6". Cadmium plated.

One-Hole Pipe Straps, Clamp Backs, and the handy new Gedney Nest Backs. These supplementary spacers nest firmly behind the Clamp Backs — use as many as you need to hold pipe at desired distance from wall. Hot dip galvanized to prevent corrosion.

GEDNEY FITTINGS FIT

GEDNEY
ELECTRIC COMPANY

GEDNEY

RKO BLDG. • RADIO CITY • NEW YORK 20
Foundry, Factory and Shipping Point: Terryville, Conn.

As fundamental as woodwork finish...

No electrical contract is complete unless it contains provision for telephone raceways.

Like woodwork finish, built-in telephone conduit does two jobs. It performs a specific function. And it adds to the general appearance of the interior.

And like woodwork finish, telephone conduit belongs in the contract. You'll find it's a profitable practice to include raceways and telephone outlets in house wiring jobs.

Owners and builders are impressed with the convenience and appearance features of planned telephone facilities. And you'll be the richer for it.

BELL TELEPHONE SYSTEM

Gives the Industrial Lighting Equipment Buyer the answers to every question of Quality...

RLM
HOW RLM MANUFACTURERS WARRANTEE
CONFORMANCE TO RLM STANDARD SPECIFICATIONS
HOW THE RLM STANDARDS INSTITUTE DEVELOPS ITS SPECIFICATIONS
HOW THE RLM LABEL AIDS IN THE SPECIFICATION AND
PURCHASE OF INDUSTRIAL LIGHTING EQUIPMENT

new Questions and Answers booklet explains why it pays to buy RLM-Labeled incandescent and fluorescent Lighting Units.

Electrical Contractor: "This RLM Booklet tells why I recommend RLM-labeled units."

This new, pocket-size RLM booklet is now being distributed by progressive contractors, architects, lighting engineers and others who recommend lighting for industry. They leave these booklets on the desks of their customers and prospects because they want to be sure the buyer understands that quality lighting equipment is *worth more* because it *costs less* in the long run.

This 8-page booklet answers the most frequently raised questions concerning quality incandescent and fluorescent lighting equipment and the RLM Label. It tells the buyer what he wants to know about the RLM Standards Institute, how the minimum standards of quality for construction and performance are established and how conformance to these standards is secured. Further it explains how the RLM Label provides assurance, not only of quality but of the uniformity of that quality in each and every individual lighting unit.

Included also is a list of the 26 illuminating engineering factors which are a part of every RLM standard specification. It is because of these factors that buyers obtain from lighting units bearing the RLM Label the assurance of better performance, long life, sustained lighting efficiency and economical operation.

Copies of the Booklet and 48-page Specifications Book available from any of the 28 manufacturers of RLM Lighting Units or by writing the RLM STANDARDS INSTITUTE, Suite 819, 326 W. Madison Street, Chicago 6, Ill.

LOOK FOR MANUFACTURER'S NAME
ELECTRICAL TESTING LABORATORIES, INC.

RLM STANDARDS INSTITUTE INCORPORATED

The letters RLM stand for Reflector and Lighting Equipment Manufacturers

R191

Presto... it's UP!

17 ft. "UP-RIGHT" SCAFFOLD-ON-WHEELS set up in only 3 minutes!

"We saved over $100 in labor the first day we used an UP-RIGHT Scaffold for installing fluorescent fixtures"

says Fred L. Baumeister
New Jersey
Electrical Contractor

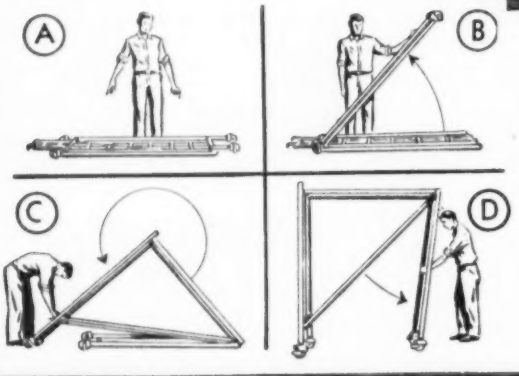
As if by magic, an aluminum alloy tower of any height desired is ready in minutes! Individual scaffold sections are set one on top of the other. Sections lock into place instantly.

HERE'S THE SECRET!...

PATENTED

ONE-PIECE SECTIONS

Each one-piece section is unfolded by one man in less than a minute! No tools, wing nuts or bolts.



Your maintenance costs can be reduced by "UP-RIGHT" SCAFFOLDS

WRITE FOR DESCRIPTIVE CIRCULAR

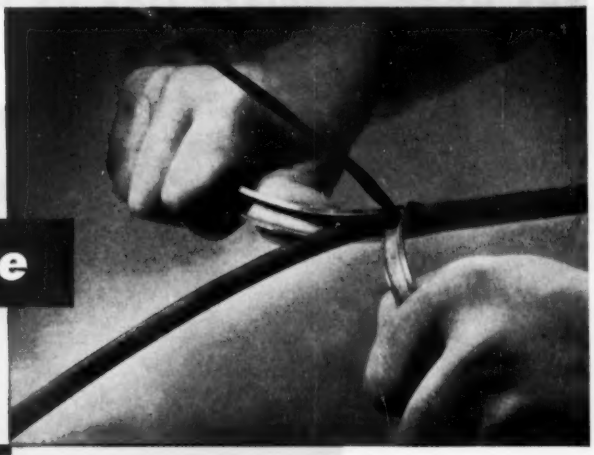
"UP-RIGHT" SCAFFOLDS

DEPT. 107 • 1013 PARDEE ST. • BERKELEY, CAL.

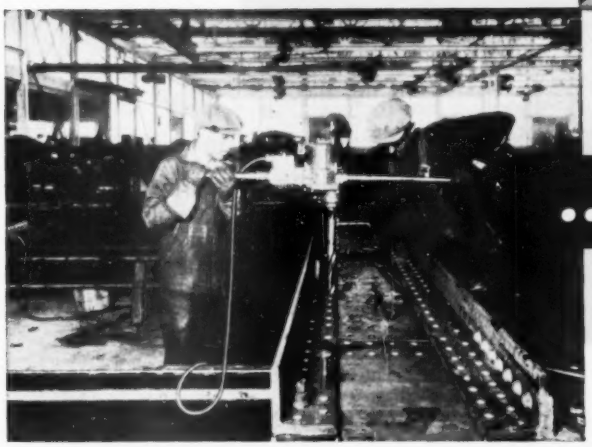
Factories: Berkeley, Calif. & Teterboro, N. J.

Offices in all principal cities

you can always tell HAZACORD®



...by appearance



...by performance

the METAL MOLD CURE makes the difference

YOU can always tell HAZACORD—first, by appearance, and second, by performance. It's the metal mold cure that makes the difference... makes HAZACORD the best flexible cord you've ever used.

When the metal mold in which HAZACORDS are pressure vulcanized is stripped away, the name HAZACORD appears in raised letters on the sheath, as shown in the illustration. This embossing is your proof that every foot of HAZACORD is mold cured.

But it's in performance that you find the real difference. Mold curing makes the Hazaprene ZBF Sheath denser, smoother, and tough enough to take the worst kind of beating. Despite oil or grease, heat or flame, moisture, weather, abrasion or mechanical damage, HAZACORDS keep your portable power tools and equipment on the job at all times.

Inside this rugged mold-cured sheath are extra-flexible conductors, a carefully compounded rubber insulation, and strong fibrous laterals. The design, construction and materials of each component adds to the longer service life and superior performance of HAZACORDS.

But it's the metal mold cure that makes the big difference... that tips the balance between an average portable cord and high performance HAZACORDS. It's why production and maintenance men everywhere are saying HAZACORDS *last longer, perform better* and *save money*. Write for HAZACORD BULLETIN EC-444 Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pa.

HAZARD insulated wires and cables for every electrical use

THE MOST COMPLETE LINE OF QUALITY

Switches

for industrial, commercial and residential installation

no. 5001
10A.-125V.T. 5A.-250V.

no. 5212
10A.-125V.T. 5A.-250V.

no. 1021
5A.-250V. 10A.-125V.

no. 1331
5A.-250V. 10A.-125V.

no. 260
10A.-125V.T. 5A.-250V.

no. 5231
5A.-250V. 10A.-125V.T.

Leading contractors always specify LEVITON for all their jobs – in the vast range of LEVITON switches – some of which are shown here – they always find the switch that exactly fits their job requirements. No need to ever improvise.

You'll like these LEVITON *features too:*

- Sturdy bakelite base and rivetted construction for easier, surer handling.
- Large, accessible binding-head screws for speedier wiring.
- Accurately built mechanisms of durable materials for long life and trouble-free performance.

There are LEVITON switches to meet U.L. standards, R.E.A., Federal, and C.S.A. specifications, T-rated switches, single-pole and 3-way switches, surface mounting switches, and combination devices, in a range of capacities, in brown or ivory.

LEVITON

LEVITON MANUFACTURING COMPANY brooklyn 22, New York

lasting "tack"

When the weather's cold and wet,
Gold Seal Tape sticks to the job.
Sticks when it's hot, too . . . won't smear
or dry out. A few wraps, and the job's finished . . .
one thickness insulates. Try it.
See how it saves time and trouble . . .
see why it's the
electrical worker's favorite.
Jenkins Bros. (Rubber Division),
100 Park Ave., New York 17.

FRICTION AND RUBBER TAPES
In 10-roll cartons or single rolls.
Every roll sealed in cellophane, stays fresh.

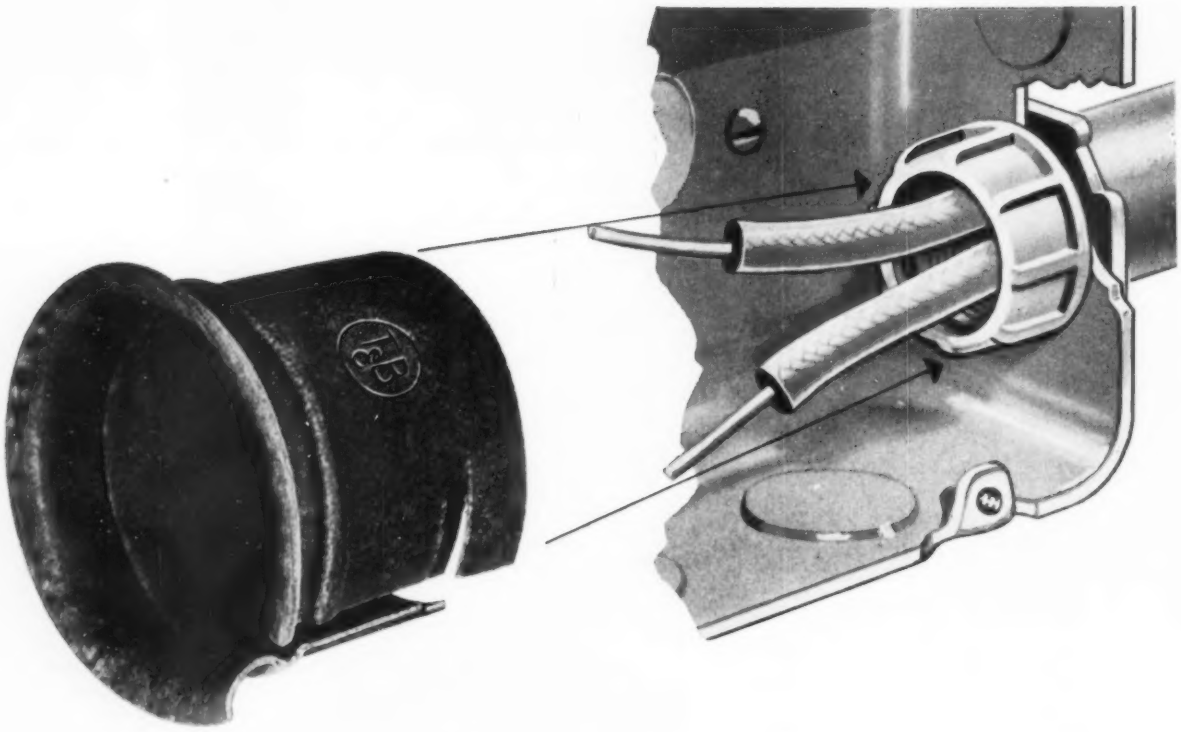
JENKINS

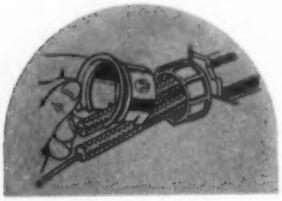
Gold Seal Tape

Jenkins Bros. also make
Diamond Seal Friction and Rubber Tapes
which meet ASTM Specifications.

A PRODUCT OF JENKINS BROS....

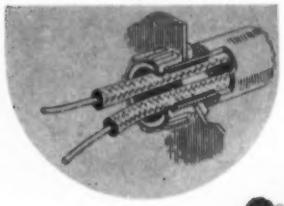
MAKERS OF FAMOUS JENKINS VALVES





Insuliner sleeves slip over cable and snap easily into non-insulated bushings, connectors or nipples — no tools are needed. Available for conduit sizes ½" to 6".

Spring tension holds Insuliner firmly in place. Deep body groove locks behind fitting lip and guards against accidental removal. Long skirt shields conduit end and provides a smooth, insulated interior surface even if the conduit is burred, uneven, or a little too short.



Meet Code requirements with

T&B INSULINERS

. . . and protect cables where they need it most

Ideal for both new or old wiring systems, T & B Insuliners prevent cable abrasion due to burred or unevenly cut conduit or E.M.T. Made of specially-processed fibre, they line and insulate any outlet.

Make it a habit to *always use* T & B Insuliners – you'll wind up with a job that costs less to install . . . a job that gets quick approval from inspectors. Patented T & B Insuliners are Underwriters' Laboratories approved for use under 1951 NEC rules paragraphs 2339, 3009, 3736B. Write for Data Sheet H2 giving complete details. T-313

LOOK FOR THIS SIGN — IT'S THE MARK OF AN AUTHORIZED T & B DISTRIBUTOR

The complete line of T & B fittings for conductors and raceways is sold only by recognized electrical wholesalers. It's our way of assuring you the service and savings of a friendly local source. Call him for all your electrical needs. T31

THE THOMAS & BETTS CO.

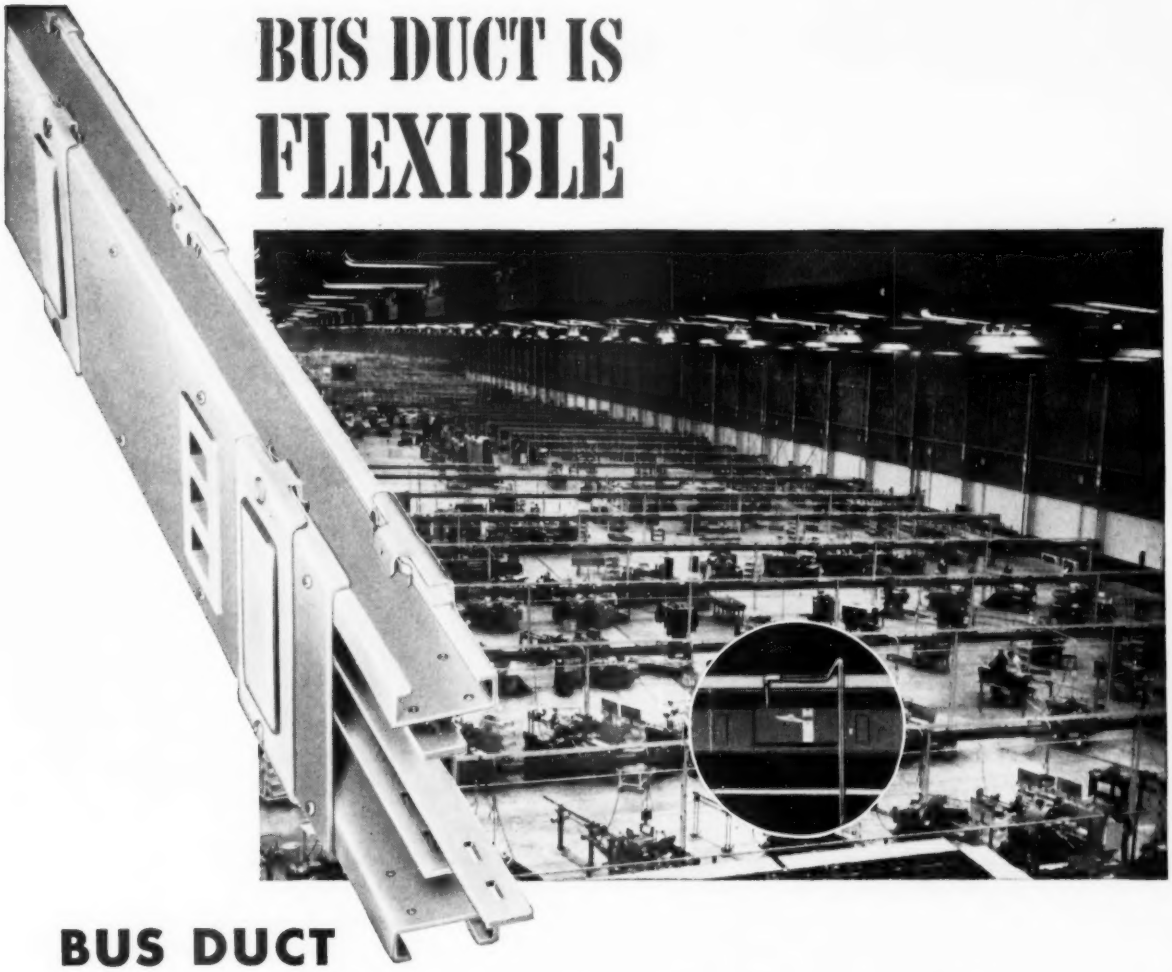
INCORPORATED

34 Butler Street • Elizabeth 1, New Jersey

Thomas & Betts Ltd., Montreal, P.Q., Canada

MANUFACTURERS OF FINE ELECTRICAL FITTINGS SINCE 1898

BUS DUCT IS FLEXIBLE



BUS DUCT solves high bay distribution problem

Mounting on angle iron standards proves highly flexible

An extremely high bay created a serious secondary power distribution problem at the Tulsa Plant of the Douglas Aircraft Company.

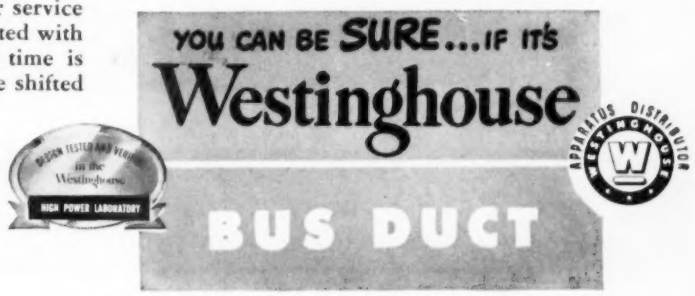
Douglas solved the problem uniquely, by mounting 4,600 feet of 400 ampere, 3-wire, 3-phase, Westinghouse Plug-In Bus Duct from angle iron standards resting on the floor. Unequaled plant layout flexibility resulted.

All Bus Duct runs are convenient to machines and exposed to view. They're mounted high enough to be out of the way, but low enough to plug in or service easily. (See circle inset.) No material is wasted with long, unnecessary lead-ins to machines; no time is lost checking circuit feeds. Machines can be shifted without affecting Duct.

Perhaps this manner of Bus Duct installation can be applied to solve a similar problem in your plant or building. Four types of Westinghouse Bus Duct are available for any service demand up to 5,000 amperes.

Get complete details from your Westinghouse Representative or write for B-4272-A, Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Penna.

J-30111



DON'T WIND UP BEHIND THE

You can't be too particular what kind of wire and cable you buy. Lack of quality invites trouble. Trouble that brings unnecessary shutdowns, rising costs, and lower production rates. Why then get substitutes when you can install Simplex-Anhydroprene, the top quality wire and cable that assures you of longer-life and trouble-saving service.

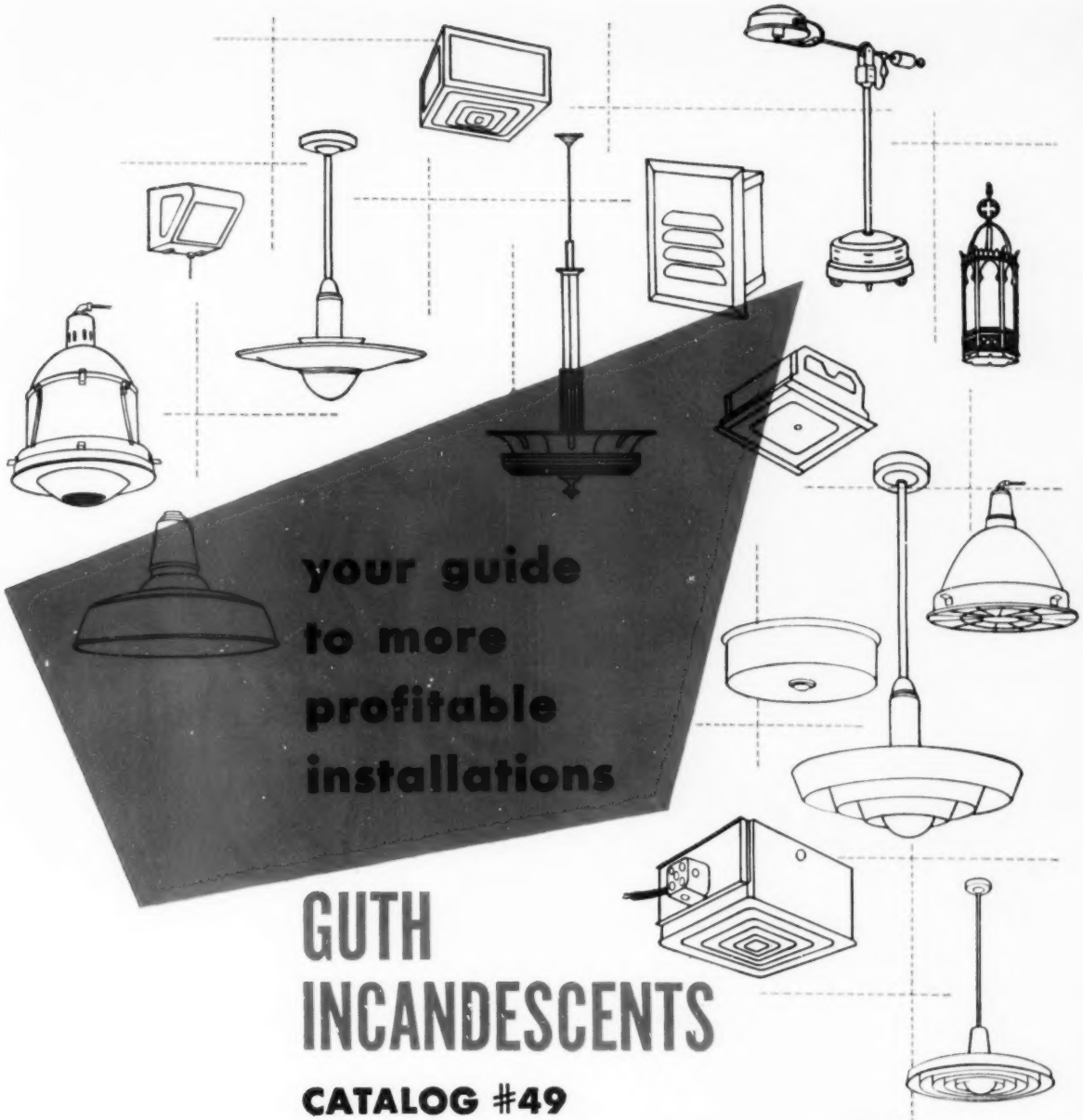
Anhydroprene construction consists of a solid or stranded coated conductor, Anhydrex insulation, and a thin neoprene jacket. Light in weight and small in diameter, it is easy to handle and terminate. Anhydroprene resists oil, grease, corrosive chemicals, light and flame. With a high dielectric strength and low water absorption, this versatile wire operates at copper temperatures up to 167°F. (75°C.).

Designed for a variety of applications, Anhydroprene assures you of increased operating efficiency. All Anhydroprene wires and cables can be racked on walls, installed in conduits and used underground in ducts for plant and shop wiring, instrument wiring, underground primaries, transformer leads, pole line risers, signal and control circuits.

Why not call your Simplex representative or write in care of the address below for more complete information on the electrical and physical properties of Anhydroprene. No obligation of course.

Simplex - WIRES & CABLES

SIMPLEX WIRE & CABLE CO.
79 SIDNEY STREET,
CAMBRIDGE 39, MASS.



GUTH INCANDESCENTS

CATALOG #49

No *one* fixture solves *every* incandescent lighting problem—but the complete GUTH Line does!

May we send you a copy?

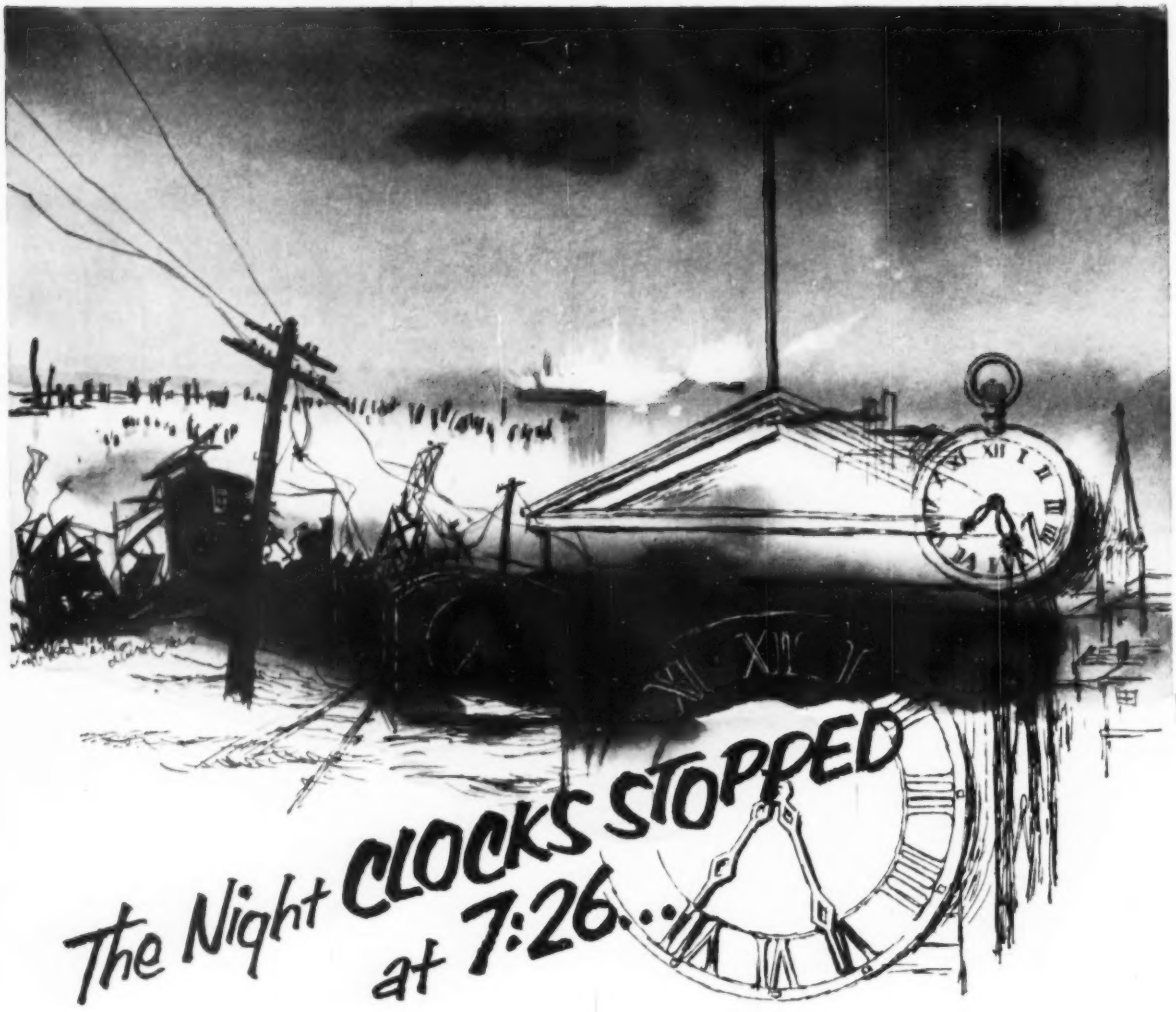
IT'S FREE!

LEADERS IN LIGHTING

Guth

SINCE 1902

THE EDWIN F. GUTH CO. / ST. LOUIS 3, MO.



Some 9,500 people were in South Amboy, N.J., that drizzly evening in 1950. At the waterfront, longshoremen were transferring the last of 12 freight cars of ammunition to lighters that would carry it to a waiting vessel in Raritan Bay.

But the City Hall clock never got to 7:27—and the freighter's deadly cargo never got loaded. Explosions shattered windows over a radius of 12 miles; and hundreds of people looked at their arms and legs and saw that flying daggers of glass had stabbed them.

At dawn, 312 of the injured had been counted.

* * *

Such disasters have happened many times before in America. They could happen again. And *if* they do—and *when* they do—there must be blood plasma on hand to take care of the injured. For blood saves lives!

But blood cannot be mined or manufactured. It must come from the veins of healthy men and women. Men and women who feel concern for a suffering neighbor. So give blood—now!

Whether your blood goes for Civil Defense needs, to a combat area, or to a local hospital—this priceless, painless gift will some day save an American life!

Give Blood Now

CALL YOUR RED CROSS TODAY!

National Blood Program

Business Executives!

√Check These Questions!

If you can answer "yes" to most of them, you—and your company—are doing a needed job for the National Blood Program.

- ☐ Have you given your employees time off to make blood donations?
- ☐ Do you have a Blood Donor Honor Roll in your company?
- ☐ Have you set up a list of volunteers so that efficient plans can be made for scheduling donors?
- ☐ Have you arranged to have a Bloodmobile make regular visits?
- ☐ Has your management endorsed the local Blood Donor Program?
- ☐ Have you informed employees of your company's plan of co-operation?
- ☐ Was this information given through Plant Bulletin or House Magazine?
- ☐ Has your company given any recognition to donors?
- ☐ Have you conducted a Donor Pledge Campaign in your company?

Remember, as long as a *single* pint of blood may mean the difference between life and death for *any* American . . . the need for blood is *urgent!*

PITTSBURGH STANDARD

"THE STANDARD OF THE TRADE"

more quality conduit for America's electrical growth

More Pittsburgh Standard quality conduit will soon be on its way to our nation-wide markets, as new production facilities are being added for "the conduit standard of the trade." Pittsburgh Standard's ultra-modern new Morrisville (Pa.) Plant, adjacent to the huge Fairless Works, will mean even faster service, greater tonnage and the same guaranteed perfect conduit.

So widely accepted has been our product name, so fine its reputation, that after 50 years we have changed our company name from Enameled Metals Company to the "brand name" called for wherever quality conduit is used . . . PITTSBURGH STANDARD.

Rigid Steel Conduit and E.M.T.

Electro-Galvanized • Black Enameled
Hot Dip Galvanized • Elbows, Nipples, Couplings
Briegel E.M.T. Fittings

AGENTS IN PRINCIPAL CITIES

MORRISVILLE, PA. (Philadelphia) PLANT—1952

The New Name for Enameled Metals Co.

PITTSBURGH STANDARD CONDUIT CO.

OFFICES:
61 Bridge St.
Pittsburgh, Pa.

PLANTS:
Etna, Pa.
Morrisville, Pa.

Fixtures and frames... surface raceways

Control panels... junction and outlet boxes

Bus ducts... bridle rings... switch and cable

Conduit... communication wiring and equipment

Antennae... radar and television installations

Beat down fastening costs, into steel or concrete with super-speed *Ramset Jobmaster*

FASTENING SYSTEM

Prove for yourself the dollar-and-cents economy and amazing time saving by doing fastening jobs like these, and many others, with RAMSET JOBMASTER and Tru-Set Fasteners. Without any obligation, your local dealer will show you, right on the job, how thousands of RAMSET users have profited, for six years, from the super-speed RAMSET SYSTEM.

Compare JOBMASTER split-second fastening with any other method. See the compact, light-weight, one-piece tool, with fast opening and loading, trigger action and one-hand operation. Watch how Roto-set safety shield, angle fire control and the exclusive Red-Tip Pilot assure perpendicular contact of Tru-Set Fasteners with the work, for straight, firm penetration and highest efficiency.

* SEND FOR "HOW-TO-DO-IT" BOOKLET

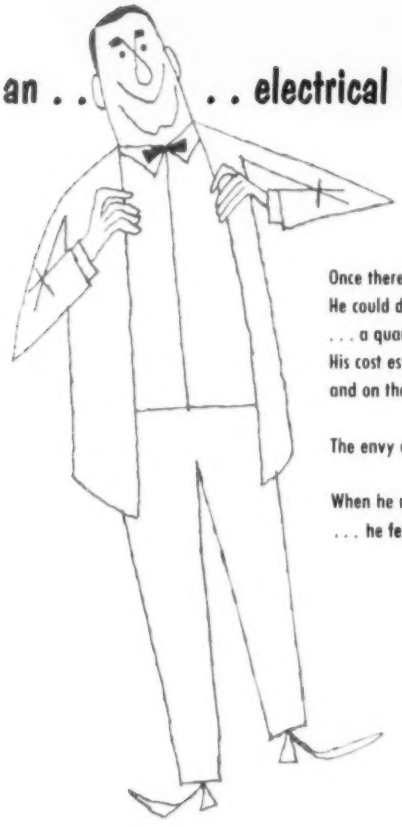
Gives detailed suggestions and diagrams for scores of jobs. Tells how to select the best Tru-Set Fastener and power charge. Points out many ways to do your fastening work faster, easier, at lower cost, with RAMSET SYSTEM. Ask your RAMSET dealer for your copy of *Modern Fastening Methods* or write us.

Ramset Fasteners, INC.

Ramset Division, Olin Industries, Inc.

12117 BEREA ROAD • CLEVELAND 11, OHIO

an . . . . . electrical man discovers the missing link



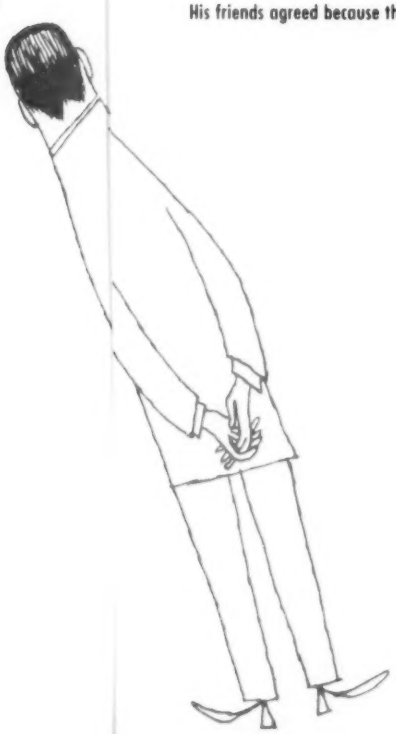
Once there was an electrical man . . . a truly accomplished gent.
He could do a job layout with one hand
. . . a quantity take off in the twinkling of an eye.
His cost estimating was ne plus ultra
and on the job he could swing a hickey with the best of them.

The envy of his friends, he was undisputed master of all situations electrical . . . save one.

When he needed reliable product information . . . in a hurry
. . . he fell flat on his capable face.

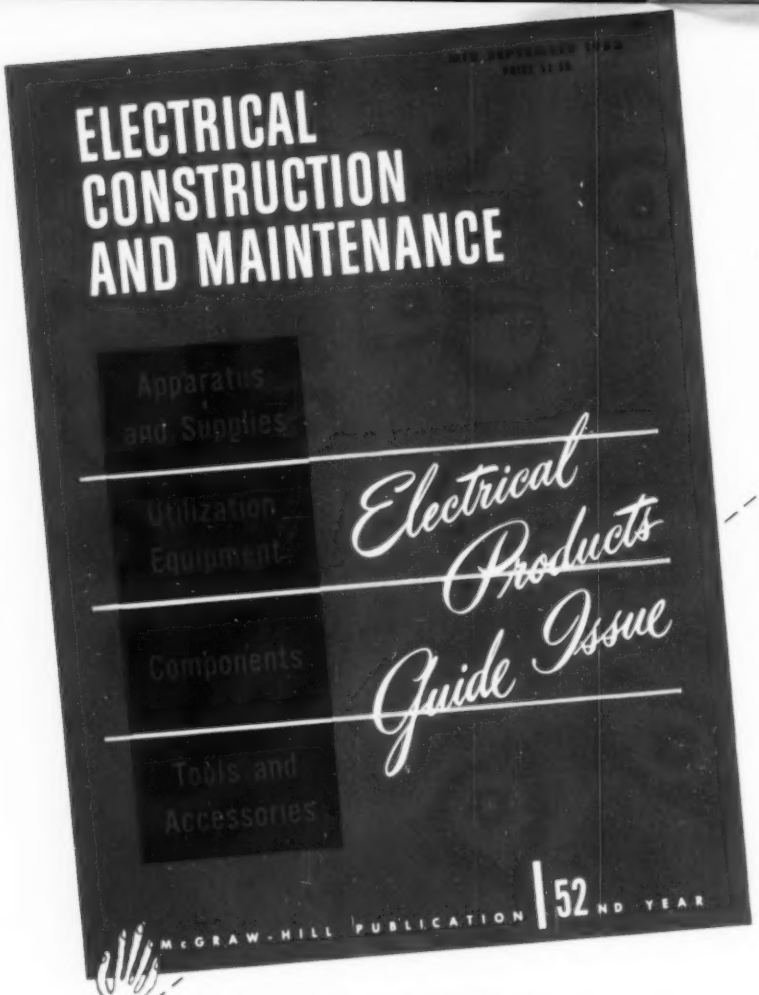
He often remarked to his admiring friends "What this 2½ billion dollar industry needs is an authoritative reference on all kinds of electrical products that we use on jobs. One we can really rely on. **It's the industry's missing link.**"

His friends agreed because they had felt the pinch too.



One day our electrical man was reading through
the March issue of **ELECTRICAL CONSTRUCTION AND MAINTENANCE**
(just as you're doing right now).
Suddenly, he came across an announcement of startling importance.

As he opened the fold (which we suggest you do)
he was heard to exclaim **"AT LAST!"**



AT LAST

YOUR YEAR 'ROUND GUIDE TO VERIFIED PRODU

E
P
G

. . . a 13th issue, coming to you in mid-September as a regular part of your subscription to ELECTRICAL CONSTRUCTION AND MAINTENANCE.

E
P
G

. . . the only complete . . . and completely verified . . . reference on electrical apparatus and supplies, utilization equipment, components, tools and accessories and allied products.

IT'S WHAT YOU ASKED FOR

If you're one of the many men who write to us repeatedly, for "who makes" and "where-to-buy" information, our decision to publish the EPG is largely the result of your persistant and expressed need for a reliable source of electrical product information.

And if you're one of the many men who have talked to us about the type of information that would be "most useful" in the EPG, you'll be pleased to find that it contains those elements that you suggested were essential in a desk-top product reference.

EPG TO HAVE 4 PRINCIPLE SECTIONS

Technical Data Reference Section

This section will be a collection of data most frequently used in electrical engineering and construction practice. It will include symbols, definitions, formulae, diagrams, and tables.

Company and Trade Name Directory

This section will contain manufacturers' names listed alphabetically for quick reference, showing street address, city, zone and state. Trade names in capital letters will be interspersed alphabetically with company name listings. Each trade name will be identified with the company claiming it.

Product Directory

This section will contain more than 1600 products listed alphabetically by headings researched for quick identification. In cases where products are known by more than one name, cross-references will be used. Where necessary, products will have brief definitions. Manufacturers will be listed alphabetically under each product heading.

Manufacturers' Product Data Section

This section will contain complete information on each company's line of products.

ALL LISTINGS WILL BE *VERIFIED*

To insure complete accuracy, thus enhancing the EPG's value to you, all manufacturers who desire listings in the Product Directory will be required to submit proof of product availability.

USEFULNESS IS THE THEME FOR EPG ADVERTISING

We have informed manufacturers of the type of advertising you want in the EPG. We have told them you are interested in new products, improvements and added features; technical data; price information; application data and suggested uses; branch office locations; technical aid facilities; evidence of product superiority and a host of other points that you said you expected in advertising in order for it to be really useful. We're certain that the manufacturers will give you the type of information you need.

KEEP YOUR EPG UNDER LOCK AND KEY

As you can see, the EPG is going to be an extremely valuable addition to your reference shelf. The EPG won't reach you for sometime. However when it does, we urge you to take very good care of it. High production costs will make it almost impossible to obtain a replacement copy if your original copy becomes lost or damaged.

Remember, your copy of the EPG is coming in mid-September. Watch for it!

We value nothing else so much as your loyalty and interest as a subscriber to ELECTRICAL CONSTRUCTION AND MAINTENANCE.

It is our strong conviction that you are a subscriber to ELECTRICAL CONSTRUCTION AND MAINTENANCE because the magazine is of real and timely value to you. And we feel just as strongly that your interest and continuing loyalty dictates that we do our best always to give you the most alert, useful and practical editorial service that we know how to provide.

To do so, we are constantly tuned to your needs and wants. The Electrical Products Guide issue is a natural result . . . for the thousands of requests we receive from you each year for advice and help in finding sources of supply is strong evidence that there is a very real need to make available periodically, in one handy volume, a source book of reliable product information.

We are sure that you will find the Electrical Products Guide issue such a source for this information. And we are glad of the opportunity to make such a service available to you, particularly at a time when industry progress and technical growth are calling for more convenient and better sources of data for your daily tasks.

We believe you will find the Electrical Products Guide a valuable and welcome supplement to the wealth of information you find each month in the pages of ELECTRICAL CONSTRUCTION AND MAINTENANCE.

Cordially,

Wm. T. Stuart

W. T. Stuart
Editor

ELECTRICAL CONSTRUCTION AND MAINTENANCE

A McGRAW-HILL PUBLICATION

330 WEST 42nd STREET, NEW YORK 36, N.Y.

ROLLER SMITH ELPECO

EQUIPMENT "Stands up" UNDER . . .

"TRIANGLE TESTING"

ROSELAND (N. J.) SWITCHING STATION OF PUBLIC SERVICE ELECTRIC & GAS COMPANY

SIEGFRIED (PA.) SUBSTATION OF PENNSYLVANIA POWER & LIGHT COMPANY.

When you purchase Roller-Smith and Elpeco equipment you are *assured* of perfect performance and extreme durability. Before any design is finally approved, both development models and production units are tested in accordance with applicable standards. Interrupting capacity and high current testing is done "in the field" under conditions of system stability exceeding those encountered under normal service conditions. The Roller-Smith Test Station, located directly adjacent to the Siegfried Substation, receives power at 66 KV from the 220 KV transmission system forming the Siegfried-Roseland-Plymouth Meeting "Triangle." Testing in this manner, rather than simulating the power conditions, insures your getting "more for your money" when you specify and buy—Roller-Smith and Elpeco.

PLYMOUTH MEETING (PA.) SUBSTATION OF PHILADELPHIA ELECTRIC COMPANY

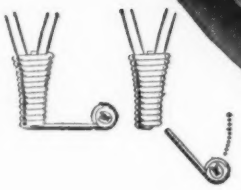
ROLLER SMITH

ROLLER-SMITH CORPORATION AND ELPECO DIVISION

BETHLEHEM, PENNSYLVANIA

ELPECO

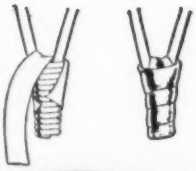
(1) "SCOTCHLOK" Electrical Spring Connectors fasten the wires together neatly and quickly! Just twist these tight-gripping spring steel connectors in place, then snap off the winding stem. See how the spring tension holds tight! "Scotchlok" won't shake loose. And it's neat, *compact!*



THE NEW 1-2 SPLICE

It combines two great "Scotch" products to give you the world's safest, most compact connection.

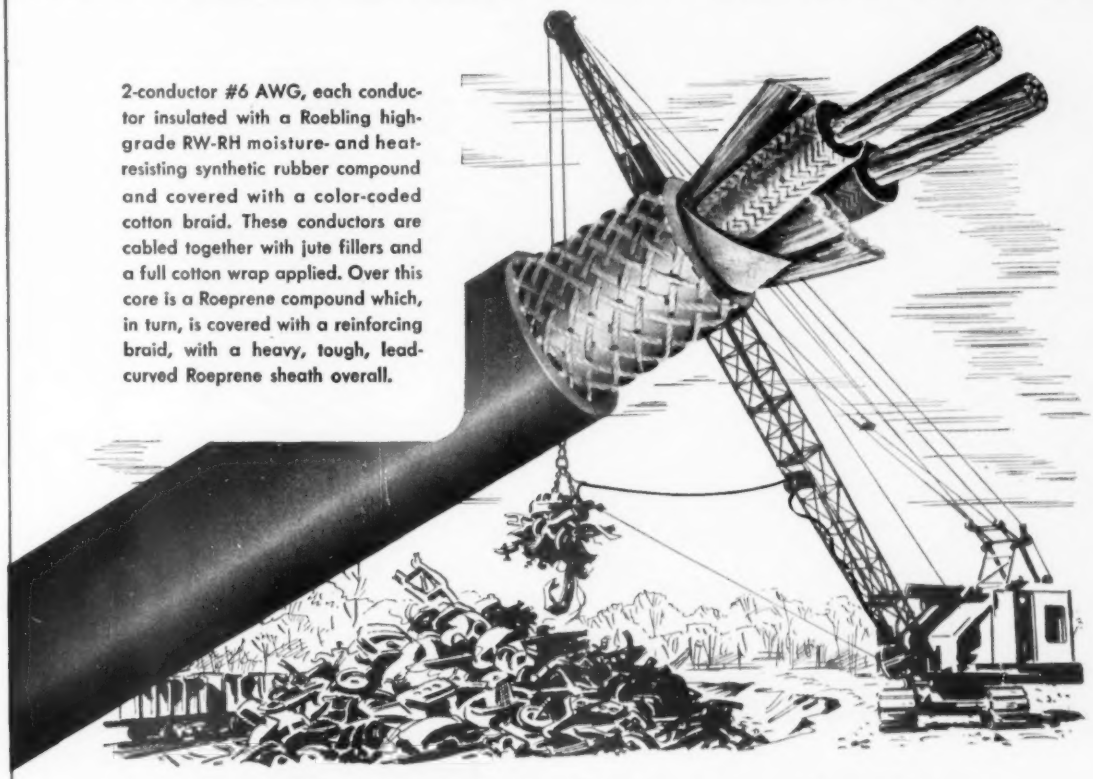
(2) "SCOTCH" Electrical Tape No. 33 insulates the splice *right!* Start by attaching tape to Spring Connector as shown, bringing it forward between the wires to seal up the bell end. Then wrap until tape extends ½-inch beyond small end. Fold extension over and wind tape back toward bell end. It's *permanent.* Order "Scotchlok" and "Scotch" Plastic Electrical Tape No. 33 today! Both carry UL seal.



The term "Scotch" and the plaid design are registered trademarks for the more than 200 pressure-sensitive adhesive tapes made in U.S.A. by Minnesota Mining & Mfg. Co., St. Paul 6, Minn.—also makers of "Scotch" Sound Recording Tape, "Underseal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-slip Surfacing, "3M" Abrasives, "3M" Adhesives. General Export: 122 East 42nd St., New York 17, N. Y. In Canada: London, Ont., Can.

ROECLAD PORTABLE POWER CABLES

2-conductor #6 AWG, each conductor insulated with a Roebling high-grade RW-RH moisture- and heat-resisting synthetic rubber compound and covered with a color-coded cotton braid. These conductors are cabled together with jute fillers and a full cotton wrap applied. Over this core is a Roeprene compound which, in turn, is covered with a reinforcing braid, with a heavy, tough, lead-curved Roeprene sheath overall.



Roebling Roeclad Lifting Magnet Cables outlast all others 2 to 1

Roebling Roeclad Lifting Magnet Cable is engineered and produced to withstand rough treatment and to give long service life. The design of this cable is based on field experience of more than 30 years.

Exhaustive tests performed in Roebling laboratories to prove the superiority of Roeclad Lifting Magnet Cables included fatigue and impact tests of representative samples.

In a fatigue test, cable samples after being subjected to more than 2,000,000 reversals—half at room temperature and half at 0°F.—showed no damage to either of the two conductors.

In impact tests, it required over 3000 blows of a 20-lb. weight dropped 5½ inches, 25 times per minute, to cause failure of a two-conductor #8 AWG Roeclad Lifting Magnet Cable.

And a report from an engineering company which has a large number of machines equipped with magnets is typical of the entire field... that Roeclad Lifting Magnet Cable out-performs competitive cables by at least 2 to 1.

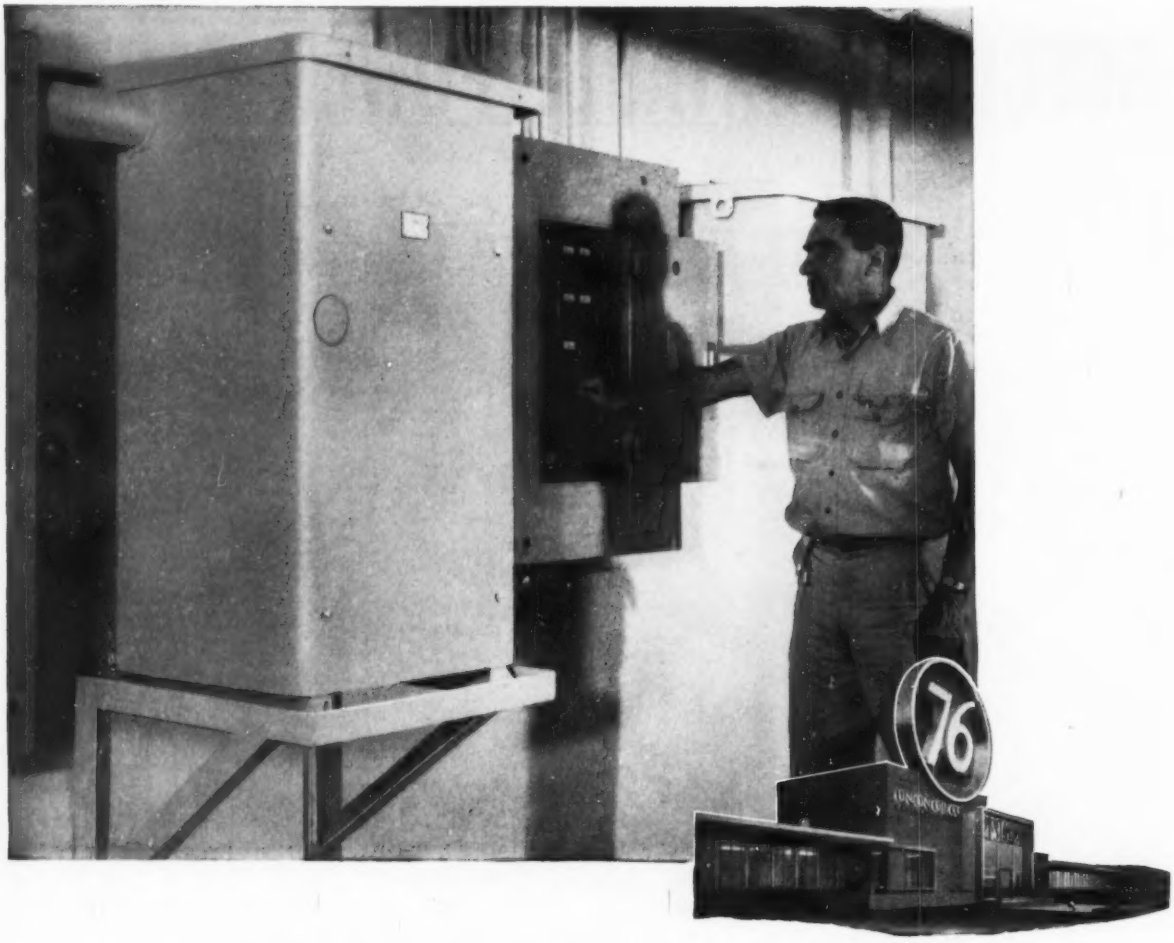
Through unending research and development, Roebling's complete electrical line is constantly being improved. You can always buy Roebling with assurance of top efficiency and economy. John A. Roebling's Sons Corporation, Trenton 2, N. J.

Subsidiary of The Colorado Fuel and Iron Corporation

ROEBLING

ATLANTA, 934 AVON AVE • BOSTON, 51 SLEEPER ST & 5 PITTSBURGH ST • CHICAGO, 5525 W. ROOSEVELT RD • CINCINNATI, 3253 FREDONIA AVE • CLEVELAND, 13225 LAKEWOOD HEIGHTS BLVD. • DENVER, 4801 JACKSON ST • DETROIT, 915 FISHER BLDG • HOUSTON, 6216 NAVIGATION BLVD • LOS ANGELES, 5340 E. HARBOR ST & 120 S. HEWITT ST • NEW YORK, 19 RECTOR ST • ODESSA, TEXAS, 1920 E. 2ND ST • PHILADELPHIA, 230 VINE ST • PITTSBURGH, 1301 CLARK BLDG • ROCHESTER, 1 FLINT ST • SAN FRANCISCO, 1740 17TH ST • SEATTLE, 900 1ST AVE S. • ST. LOUIS, 3001 DELMAR BLVD • TULSA, 321 N. CHEYENNE ST • EXPORT SALES OFFICE, TRENTON 2, NEW JERSEY

CF&I



"Off-The-Shelf" transformers meet exacting laboratory standards

Two conditions—the high level of safety required in their experimental work, and dependably constant voltages—influenced the choice of transformers when Union Oil Company constructed their outstanding new Research Center.

Westinghouse Dry-Type Transformers (now available in distributor stocks everywhere) filled both requirements.

The larger of the two transformers shown above is a 75-kva unit. It is located in the basement at the center of the load area, directly under the laboratory it serves. The 25-kva transformer in the background handles the lighting load.

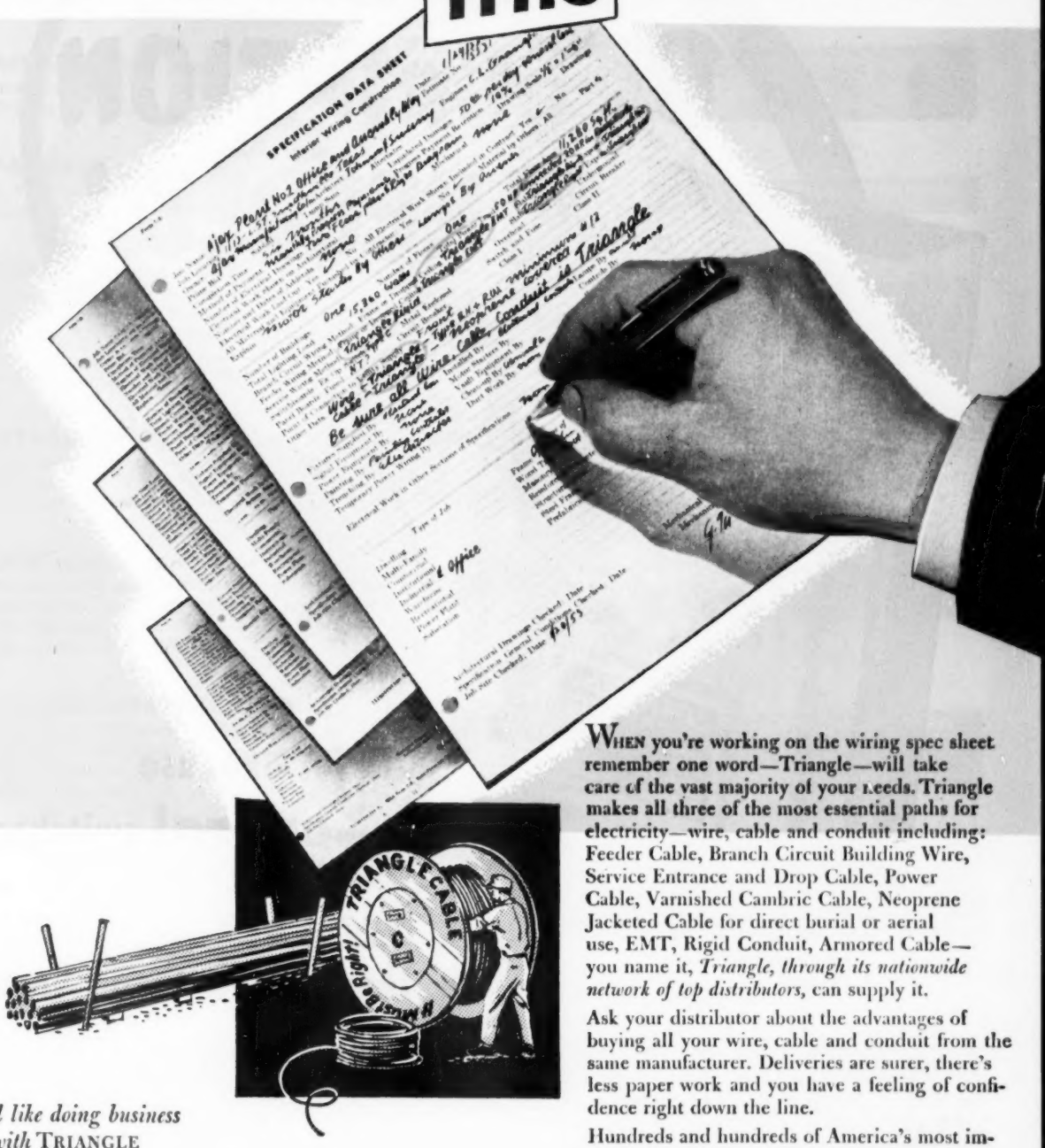
Air cooled, containing no combustible materials, these transformers could be located safely inside the building. Because their small size and light weight made installation less of a problem, they were easily mounted at selected load points . . . thus eliminating long secondary runs that would cause line losses and undesirable voltage variations.

You can meet new or changing load problems effectively and economically with Westinghouse Dry-Type Transformers. Savings include lower maintenance, operating and power costs. For further information, contact your local Westinghouse representative or distributor. Or write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70665

YOU CAN BE SURE...IF IT'S

Westinghouse

TRIANGLE'S *Complete Line* *plus* OVER 35 YEARS OF EXPERIENCE MAKES **THIS** EASY FOR YOU!



You'll like doing business with TRIANGLE

WHEN you're working on the wiring spec sheet remember one word—Triangle—will take care of the vast majority of your needs. Triangle makes all three of the most essential paths for electricity—wire, cable and conduit including: Feeder Cable, Branch Circuit Building Wire, Service Entrance and Drop Cable, Power Cable, Varnished Cambric Cable, Neoprene Jacketed Cable for direct burial or aerial use, EMT, Rigid Conduit, Armored Cable—you name it, *Triangle, through its nationwide network of top distributors,* can supply it.

Ask your distributor about the advantages of buying all your wire, cable and conduit from the same manufacturer. Deliveries are surer, there's less paper work and you have a feeling of confidence right down the line.

Hundreds and hundreds of America's most important contractors, power companies and industrials always specify high quality Triangle—across the board.

TRIANGLE
IT MUST BE RIGHT

TRIANGLE CONDUIT & CABLE CO., INC.

New Brunswick, N. J. • Moundsville, W. Va.

When it's a Question of Carrying Electrical Power—Specify **TRIANGLE**

NO DESCRIPTION NEEDED!

those who use **General** switches

know why...

they are without equal!

WRITE FOR CATALOG #5201

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ENCLOSED SAFETY SWITCHES
SERVICE ENTRANCE EQUIPMENT
BRANCH CIRCUIT PANELS

IF IT'S PARANITE IT'S the RIGHT Wire and Cable

PARAFLEX Non-Metallic Sheathed Cable lays flat. Won't squirm or twist. Clean to handle. Plainly marked.

PARASYN Type TW Thermoplastic Wire stands exposure too severe for rubber insulated wires. Smaller diameter.

PARA-USE Type "RR" Cable provides permanent underground installation from power line to meter, and for connecting several buildings. Meets requirements of CAA Specifications L-824 as Type A (on all applicable sizes).

HYDRO-THERM Building Wire combines in a single wire the heat-resistant qualities of Type RH and the moisture resistant qualities of Type RW.

URC Weatherproof Wire and Cable can be relied upon to meet severe climatic conditions. Both actual line and Weather-Ometer tests prove unusual ageing characteristics.

SERVICE ENTRANCE CABLE, Type SE Style U unarmoured and Type SE Style A armoured. There is also a Paranite Service Drop Cable, two conductor, Type SD.

DREADNAUGHT Heavy Duty Cable has lead-cured neoprene insulation. Flexible, durable, safe, long-lived. Cuts repairs and replacements. Delivers current continuously.

IF IT'S **PARANITE** IT'S RIGHT!

DISTRIBUTED THROUGH WHOLESALERS

PARANITE WIRE AND CABLE
Division of ESSEX WIRE CORPORATION
FORT WAYNE 6, INDIANA

WIRES AND CABLES SINCE 1890

WAREHOUSES AND SALES OFFICES: [illegible]

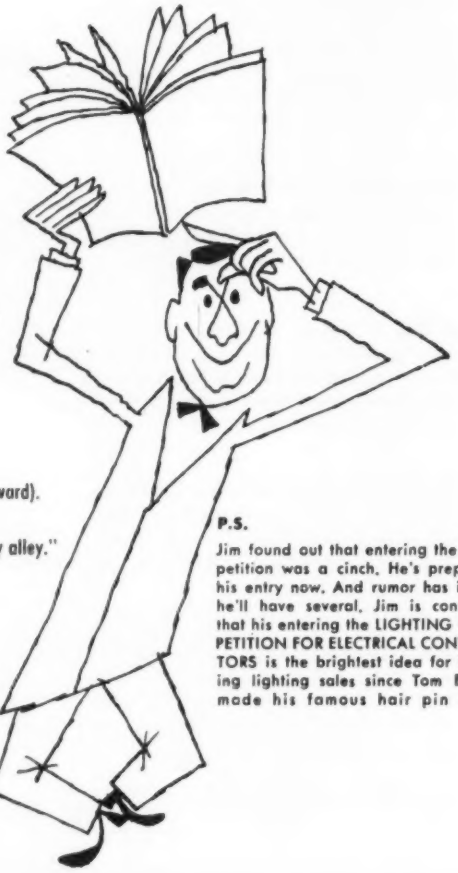
EXPORT SALES OFFICE—LIONEL-ESSEX INTERNATIONAL CORPORATION, 15 E. 26th ST., NEW YORK 10, N. Y.

ELECTRICAL WIRES AND CABLES *"BETTER THAN CODE REQUIRES"*

and the light dawned . . . PART I.

Jim Jones
. . . electrical contractor
. . . is a man
of considerable discernment,
and has a sharp eye
for a good deal.

He took great pride in his lighting jobs.
They weren't impressively large.
But they were well engineered
. . . efficient installations
that embraced the latest lighting practices.
And above all,
Jim had the satisfaction of having
initiated and sold the jobs.
How he yearned for an opportunity
to show them off.



Then one day Jim read about the LIGHTING COMPETITION FOR ELECTRICAL CONTRACTORS to "provide wide industry recognition for sales initiative and application of modern lighting technology by electrical contractors."

Jim's interest was stimulated immediately by the 18 cash prizes ($1050 in all).
But the money was a secondary consideration.
The real hook was having his entry published
in **Electrical Construction and Maintenance**
and receiving 500 reprints of the published article for local sales promotion (if it won an award).
The recognition and business building possibilities
set him to thinking. "This Competition," thought Jim, "is the cat's meow! It's right up my alley."

So Jim used this coupon
to send away for the official rules folder and some entry forms.

WHY DON'T YOU DO IT RIGHT NOW?

P.S.

Jim found out that entering the Competition was a cinch. He's preparing his entry now. And rumor has it that he'll have several. Jim is confident that his entering the LIGHTING COMPETITION FOR ELECTRICAL CONTRACTORS is the brightest idea for building lighting sales since Tom Edison made his famous hair pin glow.

Lighting Competition Chairman
ELECTRICAL CONSTRUCTION AND MAINTENANCE
330 West 42nd Street, New York 36, N.Y.

Dear Sir:

Please send me a copy of the Rules Brochure and ___ Entry Forms for the LIGHTING COMPETITION FOR ELECTRICAL CONTRACTORS.

NAME _____

COMPANY _____ TITLE _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

ELECTRICAL CONSTRUCTION AND MAINTENANCE

A McGRAW-HILL PUBLICATION
330 WEST 42ND STREET, NEW YORK 36

Efficient Layout demands efficient POWER SUPPLY

specify MOLONEY!

When building or remodeling a plant, careful thought is given to plant layout so that the ultimate can be achieved in both efficiency and production. Production flow charts, showing the proper materials handling procedures and fabrication processes and their efficient power supply are all considered in blueprint planning.

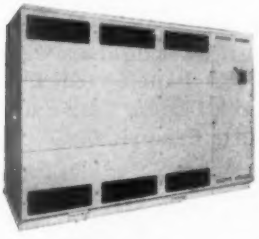
Such consideration would reveal the following features of prime importance for power supply

1. **Location Flexibility**
2. **Quiet Operation**
3. **Efficient Operation**
4. **Low Maintenance Cost**

Moloney Dry-Type Transformers will provide these features assuring you of an uninterrupted power flow under all operating conditions. Moloney Transformers also help to maintain higher levels of production efficiency for workers because of their quiet operation.

It would be wise to consider all these facts when selecting the Dry-Type Transformer to supply your power needs. If you do this, your choice will probably be Moloney . . . the transformer that gives *better performance* with *greater reliability* and *less maintenance.*

ME-52-10



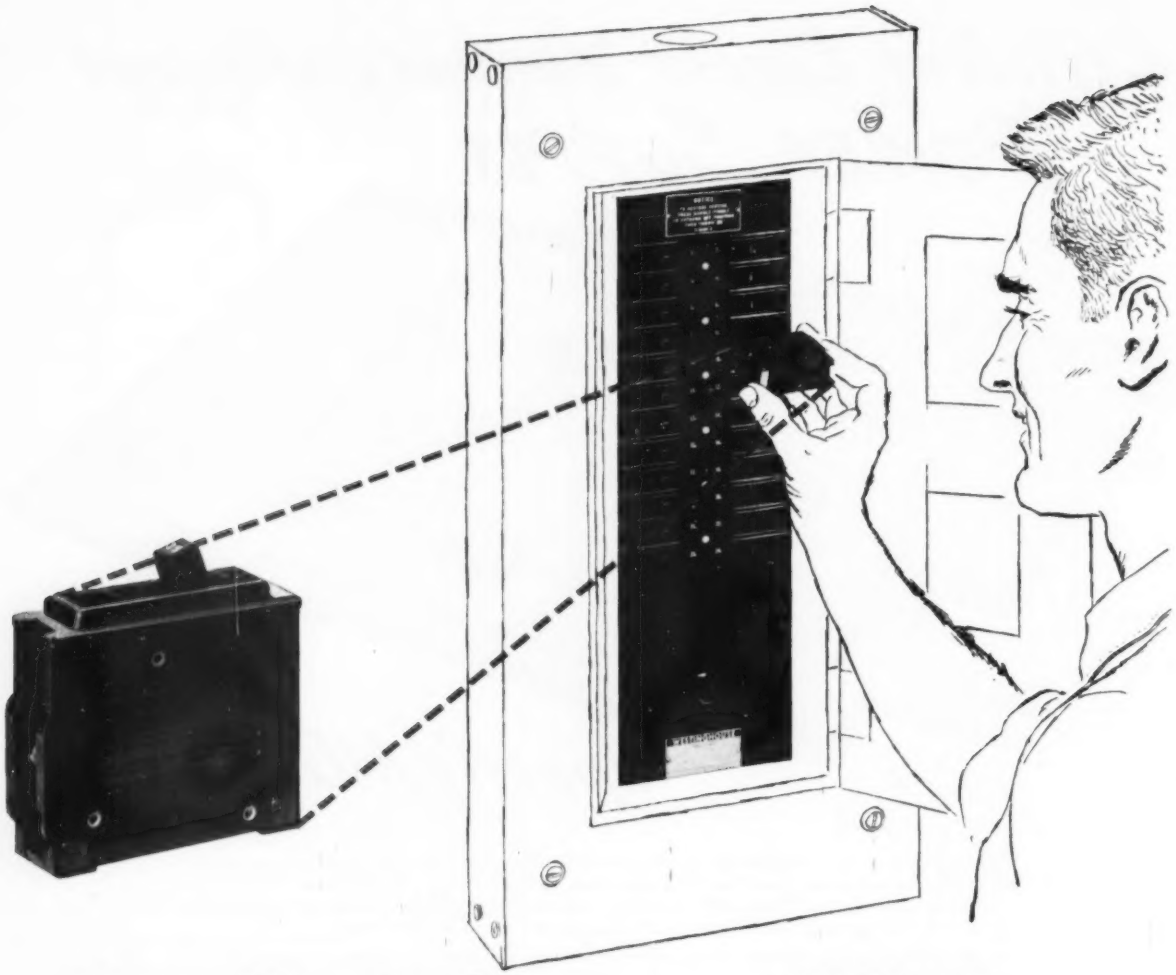
Typical Moloney Dry-Type, Air-Cooled Transformer. Primary voltages range up to 15,000 volts, and sizes to approximately 3,750 Kva. Class B insulation (80° C. rise) is used.

MOLONEY ELECTRIC COMPANY

Manufacturers of Power Transformers • Distribution Transformers • Load Ratio Control Transformers Step Voltage Regulators • Unit Substations

MOLONEY ELECTRIC = BETTER PERFORMANCE / GREATER RELIABILITY / LESS MAINTENANCE

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS, MO. AND TORONTO, ONT., CANADA



New Westinghouse type NPLAB circuit breaker lighting panelboard

1. Smaller, more compact—lighter in weight.
2. Ample wiring gutters—nothing less than four inches.
3. New type wire terminal does away with wire looping on branch breakers.
4. Snap-on covers over neutral bar and main lugs provide quick access for wire connections.
5. Identification of breaker bussing is instant and permanent—during and after installation. Takes the guesswork out of load balancing.

Quality in a panelboard—in design and construction—makes for better circuit protection. Look to Westinghouse.

Call your Westinghouse representative, or write for Panelboard Book B-5644, Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pennsylvania. J-93488

YOU CAN BE SURE... IF IT'S Westinghouse

APPARATUS DISTRIBUTOR WESTINGHOUSE

"DE-ION" BREAKER PANELBOARDS

Washington Report

New Administration policy is fast firming. Eisenhower set the broad outlines in his State of the Union message, has been filling in the details since. Based on a philosophy that "democracy has developed in an atmosphere of freedom", he is fast taking government out of the hair of business.

It's clear now that Eisenhower's big aims are: 1) a secure nation; 2) a stable dollar; and 3) an expanding economy. Officials are working out plans to fulfill these aims. Security involves foreign and military policy, and elimination of Red infiltration at home. Stabilization involves economies at home, elimination of deliberate inflation, balancing the budget to coincide with tax income. An expanding economy involves policies that encourage business and industry to meet the needs of a growing population with the opportunity for higher living standards.

Specialists have been chopping controls to size in a series of well-timed actions at Eisenhower's direction. Price control is finished, even on a standby basis. All price ceilings will be dropped before April 30 when their authority automatically ends. Wage controls, generally considered a sham anyway, are already out. And materials and product controls, due to expire June 30, will be abandoned. Eisenhower favors a simple military priority only in place of NPA's Controlled Materials Plan.

The Controlled Materials Plan has already been open-ended. As of the middle of February holders of CMP allocations of steel, copper or aluminum calling for deliveries during the second quarter will have their tickets honored at the mill, after which they may buy additional quantities they may find, without NPA approval.

After June 30 it is expected that defense contractors will be given priorities for procurement of steel, copper or aluminum. Other users will scramble for the remaining supplies. Scarce alloying metals (such as nickel, cobalt, columbium, tantalum) will continue to be allocated to the steel mills.

Copper remains the one big problem. Copper scrap was decontrolled in mid-February, resulting in a higher price for scrap than the ceiling for the refined metal.

Value of new construction put in place in January was reported at $2.3-billion by Dept. of Commerce, up 6% over January of last year, the fourteenth consecutive month to show a year-to-year gain. Private expenditures have gone into the lead again in point of percentage as compared with public construction expenditures. Private work in January topped $1.6-billion for a 7% gain; public construction was up only 4%.

But construction outlays will drop noticeably over the next two or three months. Eisenhower's economy drive on Federal spending has already hit dams, military installations, some road programs, as Secretary of Defense Wilson called a halt to all military construction that is less than 20% completed for a second look for essentiality. Possibility of lower steel prices with a rising supply will result in postponement of some civilian starts in construction until prices stable.

Total construction for 1953, however, is still expected to top 1952's record. Commercial and entertainment or amusement construction, under control for the past two years, are now forging ahead and will offset setbacks in other fields by year's end.

Industrial expansion is now at its crest, will begin to taper off in June. But electric power expansion projects are now getting top priority, to speed availability of increased power capacity for AEC plants.

This power roof ventilator runs C-O-O-L...even on hot roofs

Most successful ventilator in ILG's 47-year history!

• ILG can point to dozens of pioneering developments since 1906 for the ventilating and heating industries. But none of these prior contributions can approach the immediate acceptance and continuously increasing use of these new Centrifugal-type Power Roof Ventilators. In a matter of months these new units have found their way into the specifications and onto the roofs of important buildings throughout the nation. Today you will see them on hospitals, schools, industrial and governmental buildings everywhere. They answer the demand for "package" ventilators, easily installed, complete with desirable air-handling features, and with all parts quickly accessible. If you do not have latest data on these powerful roof ventilators for use on vertical flues or duct systems, take action today. Call our nearby Branch Office (consult classified directory) or send coupon now.

ILG knows ventilation!

Free! New engineering data bulletin No. 1902 gives you the complete story—features, sizes, capacities, dimensions. Send coupon now!

☐ Send free bulletin No. 1902

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Individual_____ Title_____

Address_____

City_____ State_____

MARCH . . . . at a Glance

Residential Electrical Systems

Whether or not your own business interests are directly concerned with house wiring, be sure to review the special feature section on residential electrical systems beginning on page 87. It develops a simple, straight-forward, functional method for designing residential wiring. Design features are built up from expected use, which permits the contractor to reach a precise understanding with the builder or owner on just what loads are to be provided for. Technical terms are avoided and with some help from the contractor, the builder or buyer should be able to understand each step in the design.

This is an important feature of the design procedure. For instance, a 20 ampere No. 12 appliance circuit is called a 2000 watt circuit or a 50 amp, 240 volt, No. 6 service entrance is simply a 10 kw service. The ratings are in operating capacity or 80% of the maximum rating of the overcurrent protective device.

The section on residential lighting should also be of special interest as the spring building season gets under way. All indications point to more built-in lighting, recessed panels and valance strips in the newer home designs.

Feeder Selection

One of the common problems of wiring design is the selection of feeders that bring into balance the desired economy and adequacy. Charles T. Paugh, P. E., of Glen Burnie, Md. presents in "Selecting Power Feeders" page 120 a systematic analysis of power feeders based on performance capability and installed costs. His methods and accompanying charts provide a handy and quick reference for finding the economical sizes of single conductors and multiple conductors for the required performance.

Lodge Lighting

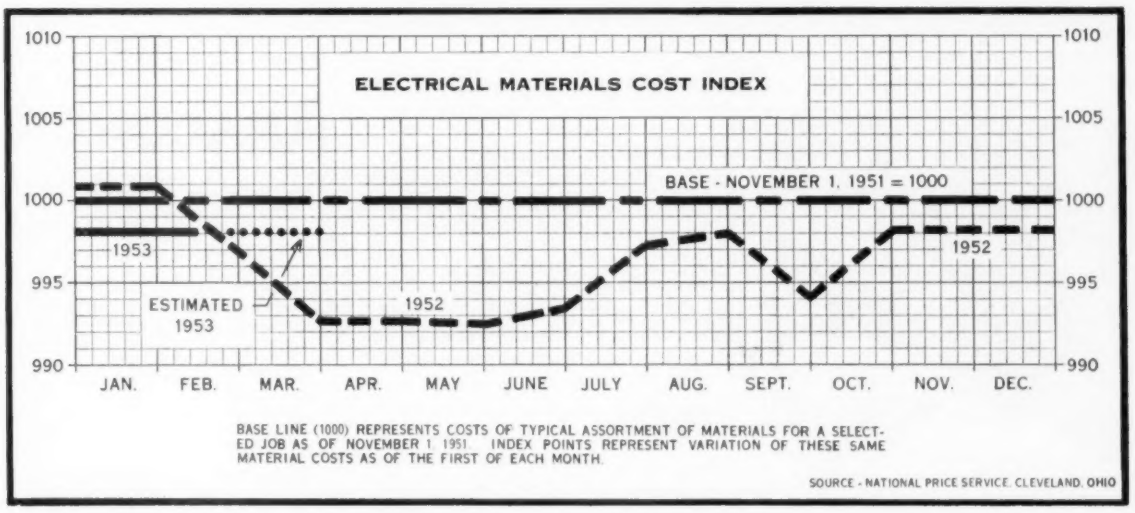
Now that NPA has greatly relaxed building construction controls on all types of commercial and recreational building, there will be renewed activity in specialized lighting for artistic and decorative effects. On page 112 is an outstanding example of one such lighting application in the Elks Temple Lodge, Coeur d'Alene, Idaho. It was designed by the author of the article, William A. Lowry, lighting consultant with the Washington Water Power Company in Coeur d'Alene.

Lighting Competition

Entry application forms for our Lighting Competition for Electrical Contractors, are going out as rapidly as the requests can be handled. If you have not sent for yours, please get your request in early and be sure to ask for enough for all of the jobs you wish to submit in the Competition.

And when you receive your entry applications, fill them out and return them promptly. You will then receive an Official Entry Folder with your registration number.

Eighteen awards will be given for the best lighting installations initiated, sold and installed by electrical contractors. The competition covers six categories of lighting installations; store interiors, schools and offices, industrial buildings, residences, floodlighting and miscellaneous. Entries will be judged on sales effect, practical or aesthetic cutomer benefit, effective use of industry aids, lighting adequacy and design and artistic appearance.



BASE LINE (1000) REPRESENTS COSTS OF TYPICAL ASSORTMENT OF MATERIALS FOR A SELECTED JOB AS OF NOVEMBER 1 1951. INDEX POINTS REPRESENT VARIATION OF THESE SAME MATERIAL COSTS AS OF THE FIRST OF EACH MONTH.

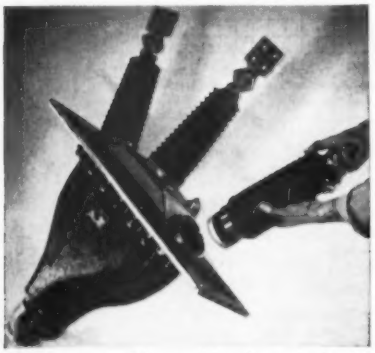
SOURCE - NATIONAL PRICE SERVICE, CLEVELAND, OHIO

Lugs, insulators, bell shapes, and cable entrances are all interchangeable. This is an important feature of AnacondA Potheads.

ANACONDA POTHEADS

This complete line is engineered by power-cable specialists for use with *any* make of cable. Parts are *fully* interchangeable for greater adaptability, faster delivery, easier installation and lower cost.

Not hundreds—but thousands of different ANACONDA Potheads can be made up from relatively few interchangeable parts. There's a type for every use—capnut, transformer, switchgear, disconnect, and through types.



Replacement of damaged insulators is simple on AnacondA Potheads. Note the ease with which any insulator can be quickly inserted.

Over 2000 different pothead assemblies can be furnished from standard parts for any particular conductor size and voltage rating in the multi-conductor capnut type alone!

To keep pace with the increasing demand for ANACONDA Accessories, it has been necessary again to greatly increase the facilities of the Cable Accessories Department. This Department is now in a position to promise prompt shipment on most of your orders.

Service continuity demands both power cable and its accessories built to highest standards. Top performance from ANACONDA Cable Accessories is assured because they are designed by engineers who are power-cable specialists.

Make Anaconda your headquarters for potheads, jointing kits, insulating compounds, paints, etc. For help on your cable and installation problems call on your Anaconda Representative to get the benefit of Anaconda's engineering experience. 52461

Accessories for all types and sizes of bare and insulated conductors.

ANACONDA®

Anaconda Wire & Cable Company,
25 Broadway, New York 4, N. Y.

Send me Anaconda's new 100-page Pothead and Terminal Catalog for use as a reference book and to simplify ordering and specifying.

NAME.....

FIRM.....

ADDRESS.....

CITY.....STATE.....

ELECTRICAL CONSTRUCTION AND MAINTENANCE

52nd Year—MARCH • 1953

New Cost Levels

SO MUCH HAS BEEN SAID and written about lower housing costs that thoroughly worthwhile objectives have become distorted out of perspective. Lower housing cost is not, as many would have us believe, an end in itself. It is only a means to bring satisfaction, comfort and sound value in family shelter to more people. Cost cutting, which offers merely less value for less money, is destructive and in the long run produces wasteful and expensive housing.

RESIDENTIAL WIRING has been a major casualty of the cost trimming process. Few of its values are readily apparent nor are they understood outside of a small circle of technically trained people. Consequently it is relatively easy to cut costs on the wiring system with little chance that the deficiencies will be detected until after title has passed to the buyer.

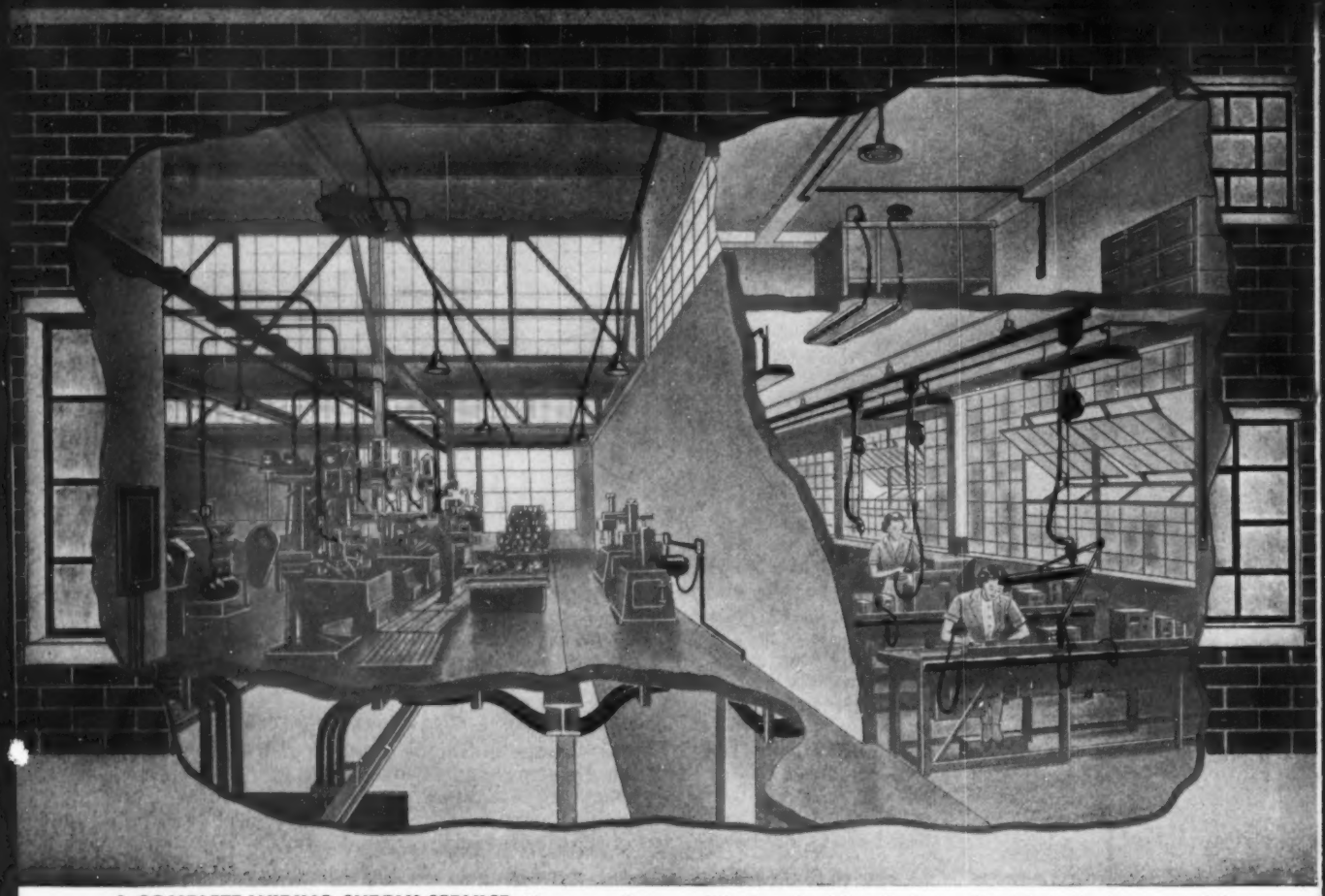
EMPHASIS ON COST REDUCTION has occurred during a period in which residential electrical utilization moved forward at an unprecedented rate. Squeezed to minimum capacity by cost pressures, the wiring system is expected to operate satisfactorily an expanding array of electrical devices and appliances.

THE ABSURDITY OF COST REDUCTION through trimming the wiring is apparent. To "save" in the original installation, the builder passes on to the owner a future rewiring job at much higher installation costs on less advantageous financing terms if the system is to serve adequately and efficiently the appliances that will surely be installed.

THERE IS NO EASY WAY OUT of the dilemma. Stubborn tradition dictates that wiring shall fit an arbitrary cost budget even when common sense directs functional design based on probable use. The first task is to establish some acceptance of new cost levels, which will encompass functional design. This will take "features," obvious and saleable values, like in-built lighting, relay switching, power centers and plug strip to help carry the less evident higher capacity wiring.

BUT MORE THAN ANYTHING ELSE new cost levels will need full industry encouragement. The big contractors and industrial electrical engineers who may have no direct interest in residential wiring still carry great influence among their social and business contacts on everything electrical. The endorsement of modern standards of electrical utilization in the home is a social responsibility of those who have the technical understanding to speak with independent authority.

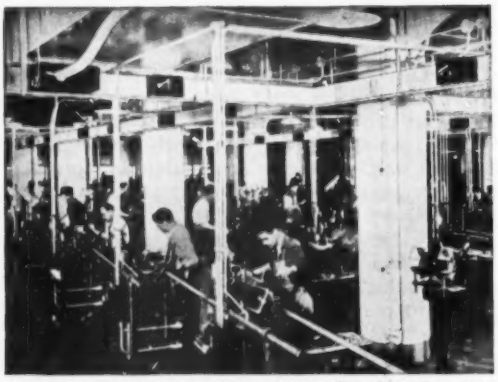
Wm. T. Stuart



A COMPLETE WIRING SUPPLY SERVICE. Your near-by Graybar office or warehouse offers a unique supply service covering electrical construction materials for industrial wiring projects of all types.

Whether the job calls for enclosed bustribution . . . conduit and fittings . . . or a combination of the two systems, you can order all of the materials you need from this *one, convenient* source — Graybar!

How to select the best distribution system for the job



Plan now for future plant flexibility. Graybar Specialists are available to help you plan distribution systems geared to tomorrow's needs. In addition to providing for future expansion and shifting of equipment, they can save you and your customer money by locating distribution centers for easy accessibility and minimum-distance circuits.

The effectiveness of any power distribution system depends primarily on the *proper combination* of the electrical construction materials that comprise it. That's the important reason why you'll find it profitable to check with Graybar on any plant wiring job.

Graybar-distributed products are made by manufacturers who are leaders in their line. Via Graybar, you can choose from the widest possible selection of electrical construction materials available anywhere. Bustribution, trolley duct, conduit, fittings, wire and cable of all types, underfloor duct, surface raceways, panelboards, switchboards, safety switches, fuses, tapes – you're sure to find the combination that's best suited to your customers' needs. And, if you plan ahead with us, we offer you the extra know-how that assures your getting critical materials on schedule.

Over 100,000 different electrical items are distributed by Graybar through its nation-wide system of offices and warehouses. Complete catalog and quotation service covering them is available to help you and your customer work out job costs and specifications – for lighting, power, ventilation, communication, as well as wiring. *Graybar Electric Co., Inc. Executive Offices: Graybar Building, New York 17, N. Y.* '222-43

Call Graybar first for...

GRAYBAR Everything Electrical

IN OVER 100 PRINCIPAL CITIES

RESIDENTIAL ELECTRICAL SYSTEMS

A manual of modern electrical system design for residences based upon the current uses and trends of electrical appliances, lighting and control.

USE of electricity in the home is advancing at a phenomenal pace. Each year end finds residential electrical kilowatt hours at a new high. New appliances and equipment move rapidly into the market for a quick and enthusiastic public acceptance. The capacity of families to absorb electrical living is evidently endless. New products and new designs create new desires before "saturation" levels off the demand for older equipment.

To most of us, the appliances or equipment appear to do the work or provide the comforts and conveniences of electrical living. The lamp gives light. The motor operates the oil burner to give heat.

But one of the extraordinary characteristics of electricity is that it is made and used at practically the same instant. The connected appliance is only the terminal utilization device of a completely integrated electrical system, no part of which can operate independently for as long as one second. The energy in the windings of the power company's generator at any moment is the sum of the energy being used by all the connected loads and losses at the same moment.

Through an intricate system of generation, transmission and distribution the utility provides, to the house connection, an electrical energy source highly refined as to voltage and frequency and capable of providing energy in any reasonable quantity. Utilization equipment is engineered to operate at a particular design voltage and frequency. Between the utility connection and the utilization device is the wiring, a vital link in the integrated system.

The electrical system design must present for effective operation, five main characteristics:

1. Accessibility

Outlets for connection must be numerous and located where they are convenient or useful for the purposes they must serve.

2. Capacity

All parts of the system must be capable of supplying the same refined energy characteristics to the utilization equipment that is provided at the utility connection. No reasonable connection or use of normal devices should cause an overload on any circuit or upon any part of the system.

3. Control

The electrical system must provide maximum operating convenience to the user under all normal conditions.

4. Isolation

The effect of faults or overloads in utilization equipment or connecting cords must be limited in extent.

5. Safety

The electrical system must be safe and secure and present no hazards to the user or to the home.

Only two of the above characteristics are normally apparent to the user of the electrical system, accessibility and control. Capacity and safety are technical characteristics apparent only to the expert. Minimum safety provisions are usually established and policed by building codes, but adequate system capacity depends upon the responsibility of the builder and the electrical contractor.

In many areas electrical industry groups offer free wiring advice and layout. A feature of this service is a certificate of wiring adequacy which is reliable assurance of sufficient capacity.

Our complete dependence upon uninterrupted and abundant electric service is a phenomena of the times. New appliances and lighting equipment add kilowatts of additional load in the average home each year. Electrical systems must be equipped to operate dependably and accommodate reasonable growth by planned functional design.

To the Trade

This editorial feature section is directed not only to you, the electrical contractor or engineer, but through you to the builders, bankers and home buyers who need to know much more about residential electric systems if practical home wiring is to keep pace with utilization growth.

To this end we have avoided wherever possible, the use of technical words and phrases, code references and symbols which would not be readily understandable to the average home builder. Instead we have used expressions like plug outlet for plug receptacle, power center for panelboard, safety device for overcurrent protective device and similar lay terms. We believe the experienced electrical reader will readily recognize the terms used and the non-technical reader will find them easier to understand than those commonly used in the trade.

Experienced electrical system designers will recognize the design methods as the modern functional approach. The system is developed from the expected utilization upstream through the circuits, feeders and service-entrance. Thus if the utilization is properly estimated and anticipated the derived system will be fully adequate.

The builder or the home buyer will find the section on "power requirements" a valuable check list. By noting exactly which appliance and equipment are to be installed and which are to be provided for in the future, he can insure that outlets and system capacity will be available.

Power Requirements

Residential electrical systems serve all of the home functions. For this reason modern electrical design must begin with an analysis of these functions and the role of electrical equipment in each.

KITCHEN AREA

The kitchen is a major center for electrical use. The system design must include plug outlets for fixed appliances, plug outlets for table appliances, and adequate lighting with convenient control. Behind the outlets the wiring must provide for full utilization of any probable connected load. It must also provide sufficient extra capacity to operate additional appliances which may be connected in the future.

Provision for cooking appliances must also be provided in breakfast areas, dining rooms and porches or patios used for outdoor dining. Grounding type outlets while not required are preferred for standard outlets in this area.

KITCHEN APPLIANCES

Appliance	Watts	Outlet	Circuit	Load
FIXED				
Range	10-12 kw.	Range	F	8000
Range	16 kw.	Range	F	10000
Range Top	6600	Range or Sp.	E	5280
Oven	5000	Range or Sp.	E	4000
Griddle	2100	Range or Sp.	E	1600
Water Heater	2000	Special	D	2000
Dishwasher-Disposer	1450	Special	C	1450
Refrigerator	300	Standard	A	300
Freezer	350	Standard	C	350
Exhaust Fan	50	Standard	B	50
Clock	2	Clock	B	—
PORTABLE				
Broiler	1600	Standard	A	1600
Coffee Maker	1000	Standard	A	1000
Egg Cooker	600	Standard	A	600
Juice Extractor	100	Standard	A	100
Grill	1200	Standard	A	1200
Roaster	1650	Standard	A	1650
Rotisserie	1600	Standard	A	1600
Toaster	1150	Standard	A	1150
Waffle Baker	1200	Standard	A	1200

LAUNDRY AREA

Another major center for electrical use is the laundry. For electrical design the area is treated much the same whether it is part of the kitchen, the utility room, the basement or in a separate room. Like the kitchen, the laundry area must have plug outlets for each fixed appliance, plug outlets for portable appliances and adequate lighting with convenient control. A grounding type outlet is required for the washer.

LAUNDRY APPLIANCES

Appliance	Watts	Outlet	Circuit	Load
FIXED				
Dryer	5000	Dryer	E	5000
Water Heater	2000	Special	D	2000
Washer	500	Standard	C	500
Ironer	1650	Standard	C	1650
Exhaust Fan	50	Standard	B	50
PORTABLE				
Iron	1000	Standard	A	1000

BEDROOM AREAS

Besides lighting outlets and plug outlets for portable lamps, the bedroom areas must be provided with plug outlets and circuit capacity to serve appliances such as electric blankets, radios, bottle warmers, heating pads, window ventilating fans or room coolers. The circuits must also be able to handle such temporary loads as electric irons or hair dryers.

BEDROOM AREA APPLIANCES

Appliance	Watts	Outlet	Circuit	Load
Room Cooler	1200	Standard	C	1200
Fan	100	Standard	B	100
Heating Pad	50	Standard	B	50
Bottle Warmer	500	Standard	B	500
Electric Blanket	50	Standard	B	50
Radio	100	Standard	B	100

BATHROOM AREAS

Bathrooms and dressing areas require adequate lighting with convenient control, supplementary electric heating and plug outlets for portable appliances.

BATHROOM APPLIANCES

Appliance	Watts	Outlet	Circuit	Load
FIXED				
Electric Heater	1500	Special	C or D	1500
PORTABLE				
Razor	10	Standard	B	10
Hair Dryer	250	Standard	B	250
Sun Lamp	400	Standard	B	400
Heat Lamp	250	Standard	B	250

RECREATION AREA

Areas devoted to family recreation require electrical capacity for relatively high level lighting, plug outlet convenience for a variety of portable lamps and appliances plus sufficient extra capacity to supply temporary uses like photoflood lamps or movie projectors.

The recreation area includes the living room, recreation room and often the dining area. Light outlets must be provided for built-in or attached lighting fixtures. Plug outlets must be provided for convenient connection of portable lamps and appliances.

RECREATION AREA APPLIANCES

Appliance	Watts	Outlet	Circuit	Load
FIXED				
TV	500	Standard	B	500
Radio	150	Standard	B	150
Record Player	150	Standard	B	150
Room Cooler	1500	Standard	C	1500
PORTABLE				
Movie Projector	750	Standard	B	750
Photoflood	1000	Standard	B	1000
Portable Refrigerator	200	Standard	B	200

CLIMATE CONTROL

Modern electrical system design requires adequate facilities for supplying the heating plant, water heater, central air conditioner, electrostatic air cleaning and blower pumps or other auxiliary apparatus.

FIXED UTILITIES

Appliance	Watts	Outlet	Circuit	Load
Oil Burner	600	Special	C	600
Water Heater	2-3000	Special	D or special	2-3000
Blower	200	Special	A	200
Air Cleaner	100	Special	A	100
Air Conditioner	5000	Special	E	5000
Sump Pump	300	Special	C	300

OUTLETS

FROM the power requirements, the number, type and location of outlets can be laid out on the plans.

The location of each fixed appliance will determine the location of its plug outlet. The kitchen, laundry or utility area plan should include an equipment layout based on all probable appliance use whether or not the appliances are to be acquired immediately. The probable location of future room coolers should be determined and a full circuit outlet located nearby.

Lighting outlets and associated switches should be laid out to supply the lighting design requirements. This is covered in detail in the following pages on Residential Lighting.

Plug outlets for portable appliances and equipment should be installed so that no point along the floor line of a useable wall space (omitting doors) is more than six feet from an outlet. A modern alternative to individual plug outlets is plug strip, installed as a baseboard molding or flush with the plaster line providing a row of outlets.

Outdoor plug outlets should also be provided at convenient points to supply electrical lawnmowers, hedge clippers and decorative lighting.

Circuits

PREFERRED CIRCUIT TYPES

A. 2000 watt 120 volt No. 12 wire
Appliance circuit serving two or more plug outlets for fixed or portable appliances in kitchen, pantry, dining areas and laundry.

B. 2000 watt 120 volt No. 12 wire
General purpose circuit serving two or more light and/or plug outlets in areas other than kitchen, pantry, dining room and laundry.

C. 2000 watt 120 volt No. 12 wire
Special purpose full circuit serving one plug outlet for an individual fixed appliance.

D. 4000 watt 240 volt No. 12 wire
Special purpose full circuit serving individual equipment load requiring 240 volts at less than 16 amperes.

E. 6000 watt 240 volt No. 10 wire
Special purpose circuit serving individual equipment load requiring 240 volts from 16 to 24 amperes.

F. 10,000 watt 240 volt No. 6 wire
Special purpose circuit serving one or more electric cooking appliances requiring 24 to 44 amperes at 240 volts.

Nominal circuit ratings are based upon loading not exceeding 80 percent of maximum safe circuit capacity.

THE number, type and location of outlets determine the accessibility and convenience of the electrical system. The circuit layout determines the capacity or capability of the system to supply uninterrupted, efficient service to any probable combination of loads which may be connected.

Each circuit must provide for the *maximum* probable load it will serve plus a 20% safety margin. The *normally connected* load on a general purpose circuit, lights and portable appliances, should not exceed 50% of the rated capacity in order to provide sufficient extra capacity for the temporary attachment of other portable appliances. For example, a bedroom outlet must be able to handle an extra 1000 watt load from an electric iron or a 600 watt vacuum cleaner.

The branch circuit of the residential electrical system conveys the energy from the distribution center to the point of attachment of the lights or equipment to be operated. The circuit originates at the main panel or a power center. It may serve one or many outlets.

Circuit Requirements

Special purpose circuit requirements can be selected and listed from the "Power Requirements." For type A circuits, following are recommended:

Kitchen and Laundry Area—Three type A circuits

Utility and Hobby Area—One type A circuit

Type B, general purpose circuits which include lighting, are calculated on an area basis, one circuit for each 500 square feet of floor area.

Example

Circuit requirements for a typical 1800 square foot house

Circuit	
Type A	3 Kitchen-Laundry
	1 Utility
Type B	1 for each 500 sq. ft.
Type C	Dishwasher 1
	Clothes Washer 1
	Ironer 1
	Room Cooler 1
	Bath Heater 1
	Oil Burner 1
Type D	Water Heater 1
Type E	Dryer 1
Type F	Range 1

No.	*Safety Device*
4	1 pole, 20 amp.
4	1 pole, 20 amp.
6	1 pole, 20 amp
1	2 pole, 20 amp
1	2 pole 30 amp
1	2 pole 50 amp

Power Centers

Circuits radiate out from power centers containing the safety fuses or breakers protecting the circuit from overload or short circuit. The power center may be a part of the main panel, but in modern wiring systems one or more power centers are located conveniently near the center of the loads.

Modern power centers are made for flush mounting in the wall and are well designed and attractive in appearance. They need not be hidden away in the basement or garage. By locating the power center near the center of the load, circuits are short and efficient; and safety devices are conveniently accessible.

Power centers are available from four circuits up. Convenient sizes for residential use are the 8 and 12 circuit types. Fused types are equipped for 15, 20, 25 or 30 ampere plug fuses with or without time delay characteristics. Breaker types take interchangeable circuit breakers from 15 through 50 ampere capacity.

From checking the circuit requirements by the method previously described, it is evident that even the smallest home with modern electrical equipment will require 16 circuits or more.

The power centers should include one "spare" circuit or blank for each five type A, B, or C circuits connected. This margin should be provided to allow for future additions to the electrical system.

When two or more power centers are installed, the circuit requirements are divided appropriately among them. Typical locations are the kitchen and the laundry or utility room. Where central air conditioning is installed or provided for, a power center is located adjacent to the heating and air conditioning equipment.

Circuit Types and Typical Uses

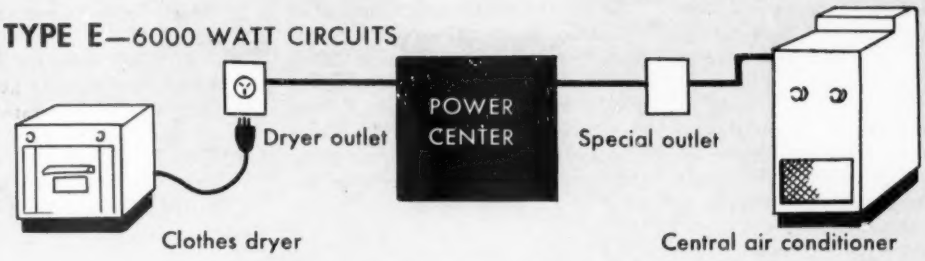
TYPE A—2000 WATT APPLIANCE CIRCUITS

TYPE B—2000 WATT GENERAL PURPOSE CIRCUITS

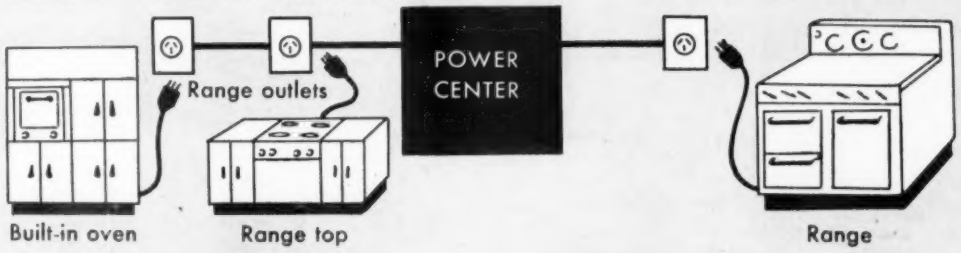
TYPE C—2000 WATT INDIVIDUAL APPLIANCE FULL CIRCUIT

TYPE D—SPECIAL PURPOSE 240 VOLT CIRCUIT 4000 WATTS

TYPE E—6000 WATT CIRCUITS



TYPE F—10000 WATT COOKING CIRCUITS



Services

TYPICAL SERVICE ENTRANCE CALCULATION

1,500 sq. ft. home with electric range, electric water heater and electric home laundry.

LIGHTING
1,500 sq. ft. x 3 watts/sq. ft. — 4,500 watts
SMALL APPLIANCE LOAD — 2,000 watts
6,500 watts

3,000 watts x 100% demand factor — 3,000 watts
3,500 watts x 35% demand factor — 1,225 watts
ELECTRIC RANGE — 8,000 watts
FIXED APPLIANCE LOAD
Water Heater — 3,000 watts
Clothes Washer — 500 watts
Clothes Dryer — 4,500 watts
Ironer — 1,650 watts
9,650 watts x 75% demand factor — 7,250 watts
Total 19,475 watts

20 KW Service Entrance required.
Wire Size for 120/240-Volt 3-Wire Service:— $\frac{19,475}{240} = 81.5$ amps.

2—No. 2 and 1—No. 4 Type R wire in 1¼" Conduit.

THE next important factor in designing a residential electrical system is the planning of the service entrance. This is actually the focal point of electrical adequacy in the home; as the service equipment ultimately limits the total energy which may be used. It is also that portion of the residential electrical system that requires the heaviest cables and the largest safety devices.

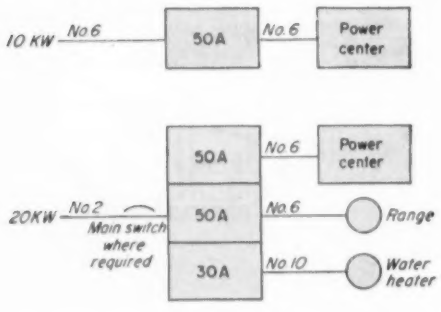
Contrary to popular belief, the design of an adequate service entrance for the home is much more complicated and less clearly defined than that of a commercial or industrial project. While electrical utilization in the latter follows a fairly set pattern based on established business or industrial practice, that in the home must serve the individual living habits of the family involved. The electrical contractor, or designer, must include this intangible in his calculations. He must anticipate probable purchases of appliances by the individual; the probable number of automatically controlled appliances that may be used; the working schedule of the housewife (possibility of the range, clothes washer, dryer and ironer operating simultaneously); the degree of electrical living the family plans to enjoy. With these facts, he can determine a reasonable "demand factor" to apply to his design.

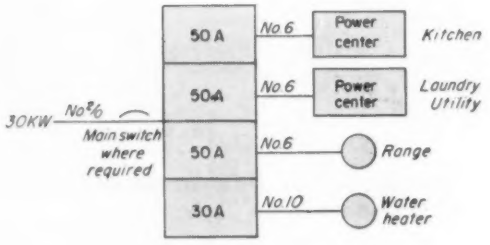
So far, the most practical method of computing residential service entrance capacity is provided by Article 220 of the National Electrical Code. It gives definite and reasonable results. However, it is based on safety considerations and may not provide the adequacy and convenience of performance desired by the home owner.

Article 220 lists the following procedure:

1. Calculate the lighting load—in watts—by multiplying the square foot of floor area (excluding porches, etc.) by 3 watts/sq. ft.
2. Add 1,500 watts of miscellaneous appliance load.
3. Take 3,000 watts of the total (1 and 2) at 100% demand.
4. Add to this 35% (demand) of the remainder.
5. This (total of 3 and 4) is the design lighting and small appliance load.
6. Add 8,000 watts for an electric range (not over 12 kw. rating).
7. Add together the rated watts of all fixed appliances.
8. Take 75% (diversity) of the total fixed appliance load and add it to the range, lighting and small

PREFERRED SERVICE ENTRANCES KW-RATED





PREFERRED SERVICES ENTRANCES 120/240—Volts 3-Wire

Nominal Rating	Maximum Capacity	Main Switch*	Main Control Center Units**	Service Wire Size	Service Conduit Size	Utilization Circuits
10 kw	12,000 watts	60 A Sw. or 50 A Cir. Bkr.	50 A Main	2—No. 6 1—No. 8	1"	General Purpose
20 kw	24,000 watts	100 A Sw. or 100 A Cir. Bkr.	2—50 A 1—30 A (Water Heater)	2—No. 2 1—No. 4	1¼"	General Purpose, Electric Cooking, Electric Laundry, Water Heater
30 kw	36,000 watts	200 A Sw. (150 A Fuses) or 150 A Cir. Bkr.	3—50 A 1—30 A (Water Heater)	2—No. 2/0 1—No. 2	2"	General Purpose, Electric Cooking, Electric Laundry, Air Conditioning, Water Heater
40 kw	48,000 watts	200 A Sw. (200 A Fuse) or 200 A Cir. Bkr.	4—50 A 1—30 A (Water Heater)	2—No. 4/0 1—No. 2/0	2"	General Purpose, Electric Cooking, Electric Laundry, Air Conditioning, Water Heater, Supplementary Home Heating (in temperate climate)

*Main switch may be omitted if six or less main control center units are used serving local power center panels.
**Main control center units may be omitted if main switch is used serving one power center panel.

appliance loads. This is the total load in watts for service entrance calculation purposes.

9. Divide this grand total by 240 (for 120/240-volt, 3-wire service) to get the ampere rating of the service conductors.

With the increase in the variety and wattage rating of the so-called "small" appliances, there is some thinking that the 1,500 watts of miscellaneous appliance load (Step 2) should be increased. Also, some designers argue, quite logically, that automatic fixed appliances should be calculated at full demand and not subject to the 75% demand. Others feel that fixed appliance diversity should permit a lower demand factor.

On custom-built homes, where the contractor can consult with the owner, these questions can be resolved and applicable demand factors determined. On housing projects where the eventual owner is not known, the Code system plus good judgment on part of the contractor should be used to establish a reasonable demand.

Rate Service in KW— A New Approach

It's not always easy to explain adequate electric service with existing terminology. Amperes and volts are unfamiliar terms to the builder and home owner. A 100-ampere service is practically meaningless to anyone outside of the trade. Watts and kilowatts, however, have a familiar ring. These terms are stamped on every light bulb, on the nameplate of every appliance. The home owner pays for his electrical energy on the basis of the number of kwhrs. consumed.

Consider the logic of talking service entrance capacity and circuit capacity in terms of kilowatts required to operate the electrical equipment in the home. Here is the common ground on which the electrical contractor and home owner can intelligently discuss wiring problems. And the chances of selling an adequate wiring installation improve when the customer understands what he will get for his investment.

Rating service entrance capacity in kw involves no new calculations. Conversion to amperes is merely a technical calculation to determine service conductor size. This bit of arithmetic is of no interest to the home owner who is paying for the number of kilowatts such a service will supply. Thus the commonly known minimum 60-ampere service should be termed a 10-kw service; the 100-ampere service, a 20 kw service and so on.

As a guide for those who will use the kw rating of service entrances, the following four types of preferred service entrances are listed:

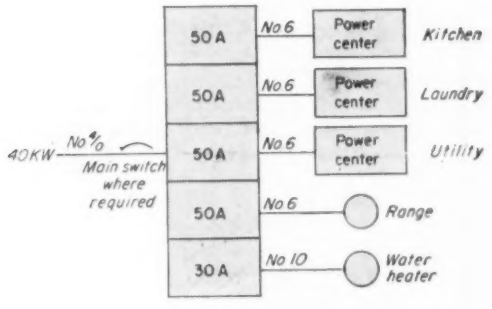
10 KW (60 A.) — Minimum Size for General Purpose Circuits.

20 KW (100 A.) — General Purpose, Electric Cooking, Electric Laundry, Water Heater.

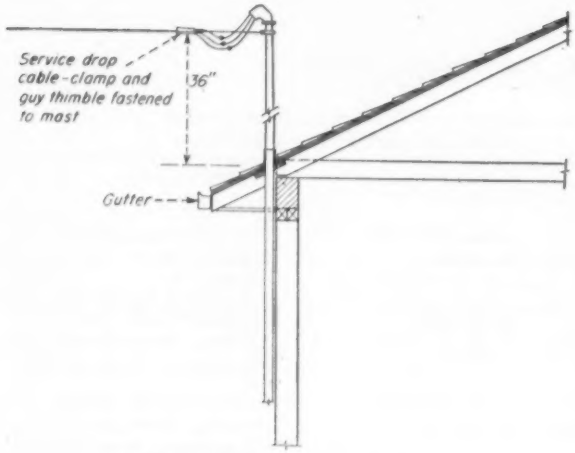
30 KW (150 A.) — General Purpose, Electric Cooking, Electric Laundry, Water Heater, Air Conditioning.

40 KW (200 A.) — General Purpose, Electric Cooking, Electric Laundry, Water Heater, Air Conditioning, Electric Home Heating. (in temperate climate).

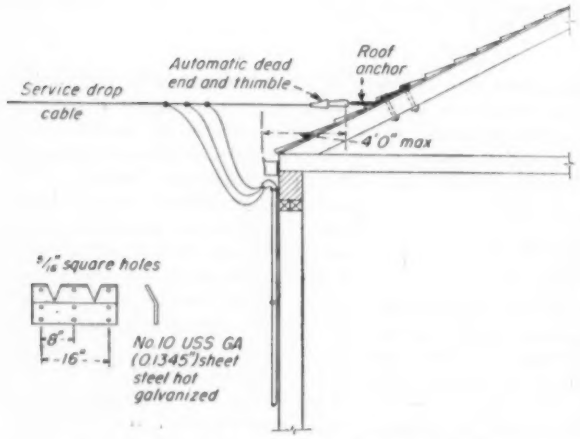
Additional details as to main control center unit divisions, service conductor size and conduit size are given in the accompanying diagrams and table.



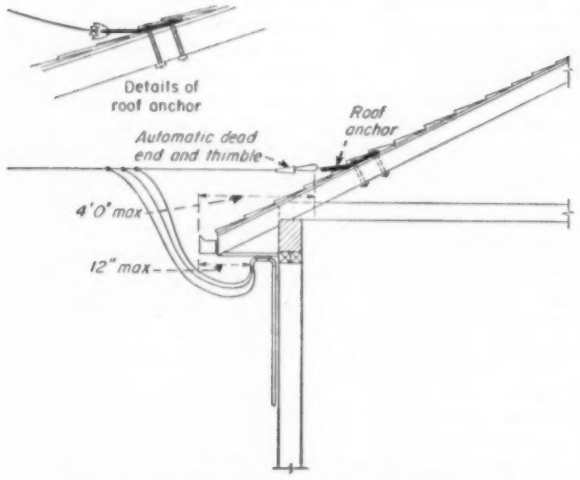
SERVICE INSTALLATIONS FOR RANCH TYPE HOMES



SERVICE MAST FOR LOW ROOF

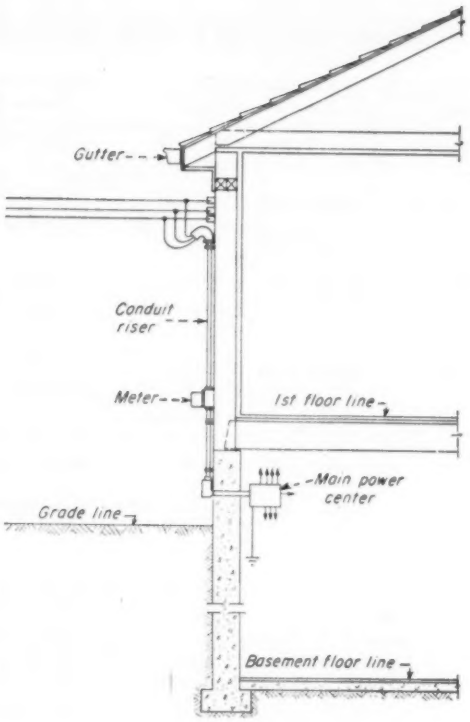


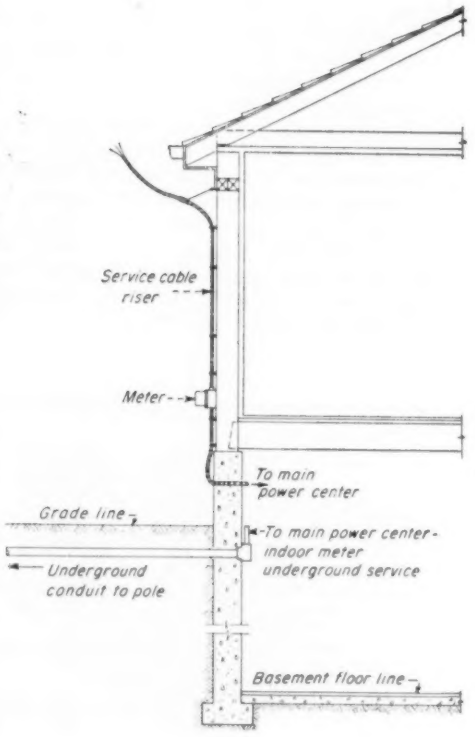
ROOF ANCHOR FOR LOW ROOF FLUSH EAVES



ROOF ANCHOR FOR LOW ROOF EXTENDED EAVES

STANDARD SERVICE TYPES





Switch Control

ADEQUATE service entrance capacity and a sufficient number of circuits of proper size are just two phases of a modern, well planned residential wiring installation. A third, and equally important phase is control convenience. Unless an electrical system is easy to control, it will not provide the ultimate in anticipated performance.

Basic control originates at the safety devices in the power center. Here the circuit is automatically disconnected from the source of supply when a fault or overload occurs in the wiring or in any attached equipment. In residential electrical systems the safety devices are rarely used as operating controls.

For operation, lighting is controlled by switches conveniently located at one or more of the entrances to the lighted area. Stair lighting is controlled from top or bottom. Outside lighting is controlled from a convenient indoor location. Closet lights are operated automatically by opening the door. And in some systems, master switching is provided to operate a number of lights over the entire house from a central point. An important feature of modern design is the switched plug outlet which provides wall switch control of the attached portable lamps.

Single-Point Control—Lighting outlets in all areas should be controlled by a wall switch located on the lock side of the door within six inches of the door frame. While standard practice is to mount these units from 48 to 54 inches above the finished floor, some designers quite logically suggest they be installed at door-knob height for convenience.

In rooms where ceiling outlets have been eliminated, a wall switch should control one or more "two-circuit" type duplex outlets. In such cases, the upper half of the duplex outlet is switch-controlled for portable lamps; the lower half remains "hot" for portable appliances. The same idea could be applied to weatherproof receptacles on porches or terraces with indoor or weatherproof outdoor switch control. Or, the entire receptacle could be switch-controlled.

Multi-Point Control—Safety demands convenient control of stairway lights from the foot and head of the stairs. A three-way wall switch at each point will accomplish this. Addition of a four-way switch will give a third point of control, perhaps in the entrance vestibule. For enclosed stairways, switches with pilot-light indicators are suggested.

Multi-point wall-switch control of lighting outlets is highly recommended for rooms with more than one entrance. Where commonly used doorways are more than 10 feet apart, 3- and 4-way switches at each door are suggested. Some home owners may desire this convenience when doorways are closer together.

The same multi-point switching convenience can be applied to lighting outlets in breeze-ways, attached and detached garages for indoor and exterior lighting units. Any area with more than one entrance offers a natural application for 3- or 4-way switch control.

Each residential wiring plan should be carefully studied to determine the most flexible and convenient plan of multi-point control to meet the owner's requirements. Mercury-type switches should be recommended, particularly in bedroom, bath and kitchens, because of their silent operation.

Master Switch Control of specific lighting outlets inside or outside the house is a plus item well worth discussing with the home owner. With such a switch in the master bedroom, the owner can turn on the controlled lights independently of local switches. When more than two circuits are to be controlled in this manner, single-pole magnetic switches in each circuit are operated by a single-pole master switch. Standard switch units to control one or two circuits are available. Biggest advantage of this feature: Frightening away petty thieves when the lights are turned on while they make an entrance.

Automatic Control—Door switches might be classed as automatic control since they automatically turn the light on and off as the door is opened or closed. Closets offer a most logical application of this type of switch. The other alternative is to use a wall switch with pilot light near the closet door or the less desirable pull chain outlet in the closet.

As an added safety feature for enclosed stairways, a door-switch controlled lighting outlet can be installed just inside the door at the head of such stairs. Thus a light would go on immediately the door is opened and reveal the stairway to those guests or others who might open the door without first operating the multi-point control switch for the stairway lighting. This plus feature might prevent a serious accident in the home.

Garage door openers with various types of automatic operation also come under this category.

Time switches have their greatest non-industrial application on the farmstead, particularly for poultry houses. The urban home also offers some possibilities. Driveway or walk post lighting units, outdoor garage lights, illuminated house numbers, garden lighting and general outdoor "protective" lighting could be easily controlled by a time switch. This offers another discussion point for the electrical contractor and home owner who desires the ultimate in residential wiring control convenience.

Low-Voltage Remote Control—Rapidly gaining acceptance in the residential field is the low voltage (24-volts) remote control of lighting outlets and receptacles. This system wraps up in a single package, single-point, multi-point and master switch control. Through the use of low-voltage relays at the electrical outlet (or grouped in a remote location) and simplified 24-volt control wiring (N.E.C. Class II signal and control

circuits) this system has extended the previous physical and economic limitations of extensive multi-point control in residential wiring. The small momentary-contact switches and 24-volt conductors lend themselves to residential electrical modernization as well as new home construction.

Signals and Communication

Electrical convenience in the home does not end at the outlet or control switch. It extends to signal and communication facilities, both audible and visual, within the confines of the residence. This specific phase of home wiring offers a challenging field for the progressive contractor.

Signaling systems can range from the minimum single door bell to the more elaborate chimes with multi-point control and audible and visual annunciators in homes with servant accommodations.

Recommended minimum is a chime with front and rear (trade) door operation that will give a different tone or note characteristic for each point of operation. If bells, or buzzers are used, each unit should have a different tone to distinguish between front and rear doors.

A signaling-type floor receptacle in the center of the dining room with cord attachment to table button and a chime or buzzer in kitchen is another "plus" feature which may interest the home owner.

An electric door-opener system combined with a loud-speaking telephone—similar to units in apartment houses—is another convenience that can be discussed with the residential wiring prospect.

Communication Systems for the home, as discussed here, include telephones, intercommunication, radio and television. Wiring channels for telephone conductors should be planned when the home is built. Service conduit, interior raceways, outlet boxes and telephone niches should be installed while the home is under construction (see drawing). Outlets can be of the conventional type for permanently connected units, or the jack-plug receptacle for portable telephones depending upon the requirements of the resident. Regulations of the local telephone company should be consulted before discussing such an installation.

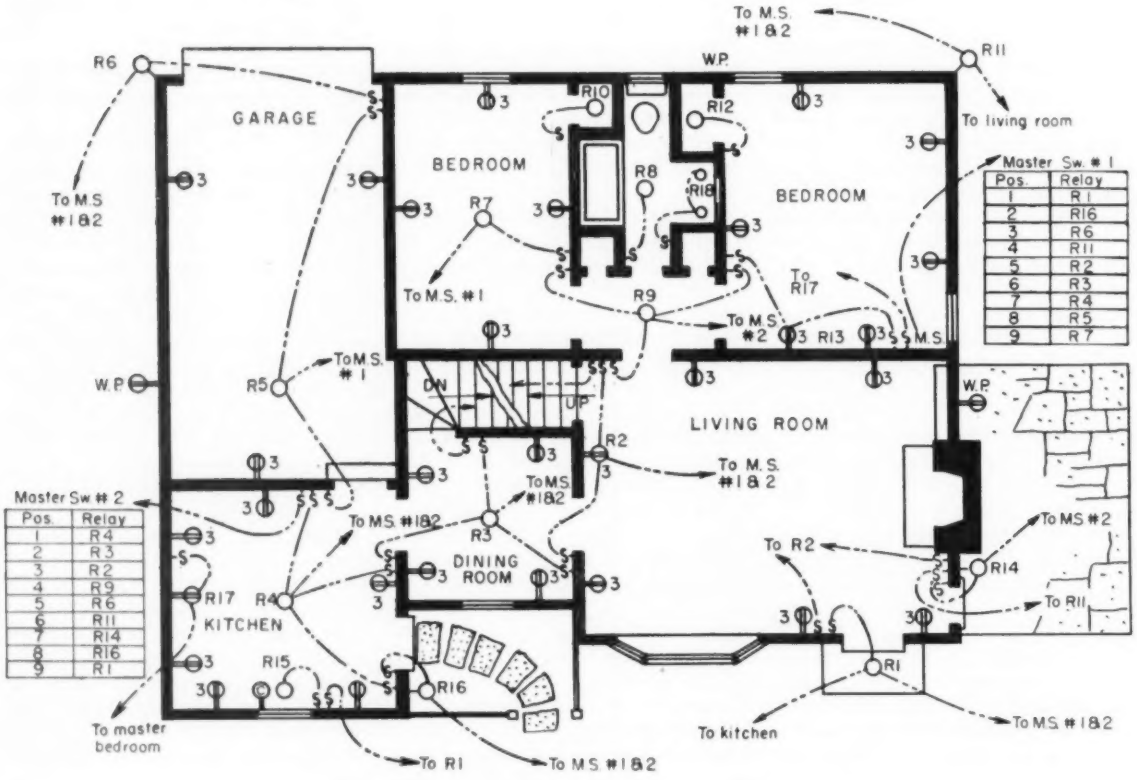
An intercommunicating telephone system affords a highly desirable convenience for the larger, luxury-type home. Manufacturer's literature provides all details on systems of this type.

The two-way, radio-type intercommunicating system, similar to that used in offices, etc., is finding increased acceptance in residential applications both in the multi-story and long ranch-type homes. Normally, one station is located in the nursery with the other in the kitchen or work area so the mother can listen to the baby in the nursery. Other stations can be added in the master bedroom, den, or hobby room to increase the convenience and make it a fairly comprehensive intercommunication system.

Radio and television antennae systems are becoming a necessity even in the lower priced homes. Multi-room antennae installations for radio are an accepted residential electrical convenience today since most homes have two or more radio sets. Television is beginning to follow this pattern with numerous homes having a set in the recreation room and another in the living room. Sometimes there is a third set in the children's room.

Multi-station television antennae systems are being economically installed in homes (see drawing) to provide outlets for operation of more than

TYPICAL LOW-VOLTAGE REMOTE CONTROL FOR A HOME



Master Sw. # 1

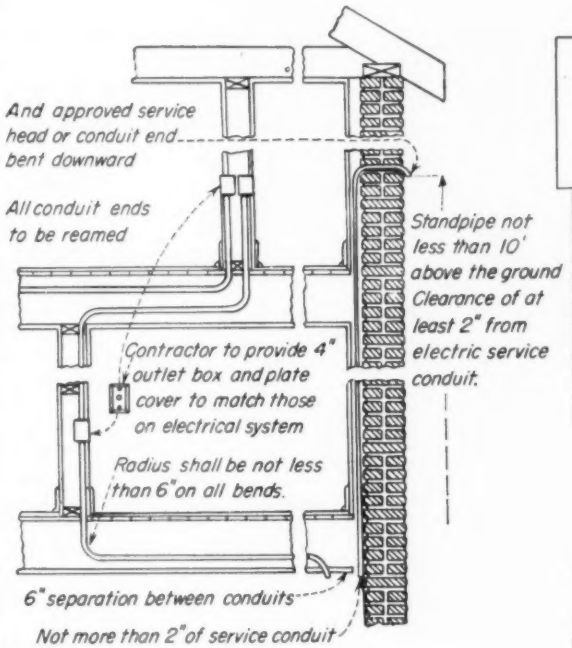
Pos.	Relay
1	R1
2	R16
3	R6
4	R11
5	R2
6	R3
7	R4
8	R5
9	R7

Master Sw. # 2

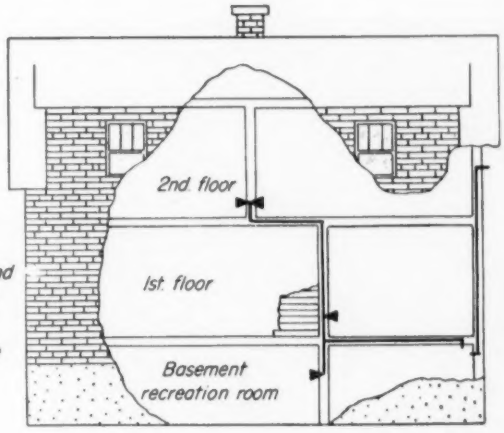
Pos.	Relay
1	R4
2	R3
3	R2
4	R9
5	R6
6	R11
7	R14
8	R16
9	R1

TELEPHONE RACEWAY SYSTEMS

OVERHEAD SERVICE ENTRANCE

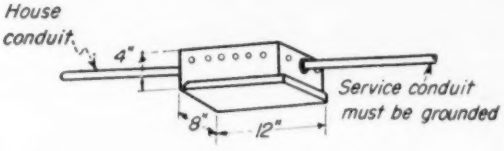

And approved service head or conduit end bent downward
All conduit ends to be reamed
Standpipe not less than 10' above the ground Clearance of at least 2" from electric service conduit.
Contractor to provide 4" outlet box and plate cover to match those on electrical system
Radius shall be not less than 6" on all bends.
6" separation between conduits
Not more than 2" of service conduit shall be exposed in basement. Service conduit must be permanently and effectively grounded

TYPICAL LAYOUT



PROTECTION CABINET

Installed when service terminates in finished basement, living quarters or recreation room.



12" dimension must be in line with conduit runs. $\frac{7}{8}$" backboard required if cabinet is mounted on plaster, brick or cement. One protector is required for each telephone line.

The protector should be located as near the service entrance as possible. It should also be located so that the grounding media approved by the National Electrical Code are reasonably available.

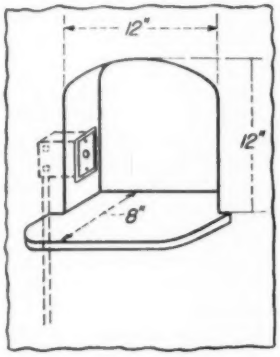
The protector should be accessible at all times. Locked rooms are not suitable locations

SIZE OF CONDUIT

Pair or triple wire	Size of conduit
1 and 2	$\frac{1}{2}$"
3 and 4	$\frac{3}{4}$"
5	1

TELEPHONE NICHE

(Minimum dimensions)



one set, or permit moving one set from room to room as occasion demands. For typical residential construction, antennae branch leads are mounted direct to the studding and terminate in a jack-plug outlet cover—or simple telephone outlet cover with lead extension to the set. Where raceways are desired, a $\frac{3}{4}$-in. (inside diameter) *non-metallic* raceway is recommended. Local television engineers will guide the contractor on the type of installation to recommend and make.

This discussion has pointed up a few of the numerous ways in which electrical convenience can be built into the residential electrical system. A number of these fall into the "must" or necessity category. Others may be considered "plus" items. All are necessary from the standpoint of upgrading residential electrical installations. All should be in the file of the electrical contractor interested in doing a good wiring sales and installation job. Each provides discussion material for promoting modern electrical living and convenience.

Where, today, can the home owner get more per dollar of investment than in a modern, adequately wired, conveniently controlled electrical installation? This is a system the family uses more hours per day, more days per year—regardless of season—than anything else in the home.

JUNCTION BOX on rear of each radiant heating panel facilitates connection to circuit wiring. Mounting of panel is by means of screws driven through margin.

Residential Heating

Radiant Heating

Radiant heating installations for ceilings, floors and walls now include plastic coated resistance wires, conductive rubber panels, heat resistant glass and aluminum covered laminates containing copper alloy wire elements. In addition to this variety of mediums, a growing mass of technical data is likewise available, helping electrical engineers to translate heat transmission of various building elements, wind velocities, types of insulation and areas of exterior glass into panel area and control requirements.

In new homes the costs for heating panels, controls, insulation, weatherstripping and double glazed windows are offset by eliminating central heating equipment, piping, chimneys, flues, radiators, basements, maintenance and service charges.

Plastic Coated Resistance Wire

Grand-daddy of residential radiant heating is the Roberson system, consisting of resistance wires coated with thermosetting plastic and cut to standard lengths to provide predetermined heat outputs. Circuits are connected to switch and thermostat boxes by means of non-heating leads run in conduit or raceways, then are connected to central distribution panels by standard 12-gauge type T branch runs.

The average home requires between 1½ and 2 watts per cu. ft. of space to be heated and cables of various lengths may be obtained with ratings of 250, 500, 1500 or 3000 watts. A survey in the Seattle area (4860 deg. days) indicated that the average home requires 1.27 kw per cu. ft. per season for heating only.

Roberson cable has a ⅛-inch diameter heating element and a maximum continuous conductor temperature of 167 degrees F. When surrounding air is 50 degrees F, the cable *insulation* is approximately 112 degrees.

Resistance wires can be stapled directly to plasterboard or other surfaces, covered by plaster, placed between ceiling joists and covered by an insulation blanket to direct heat downward, or embedded directly in concrete.

Conductive Rubber Panels

Another system receiving considerable attention consists of panels containing a layer of conductive rubber sealed between layers of insulating paper and aluminum foil. These laminated panels, manufactured by U. S. Rubber under the name of Uskon, may be obtained either as 1/16-inch thick flexible sheets or a ¼-inch thick rigid panels having the same appearance as standard interior wall board. Both sheets and panels come in 3-by-4 and 4-by-4-foot standard sizes and, in addition, the sheets may also be obtained with 4-by-6-ft dimensions. Panels have outputs of 22 watts per sq. ft.; provide 75 Btu of heat per sq. ft.; have a surface temperature of 100 degrees F, and may be operated at either 230 or 115 volts.

The number of panels required in a home is dependent upon such factors as deg. days of the area and the type of home insulation used. Panels are arranged uniformly around each ceiling —the number depending upon the heating requirements.

Joints between panels are masked with decorative moldings and the entire ceiling may then be finished with flat interior paint.

Panels are electrically connected in parallel, with circuit wires fastened either to binding posts located inside standard 4-inch boxes on the rear of the rigid panels, or to terminal blocks located on front corners of the sheets. Circuit wire is 12-gauge standard 2-conductor type T cable carried either in rigid conduit, a non-metallic sheath, or metallic armor. In those cases where rigid conduit is employed, terminal connections to junction boxes should be made through short lengths of flexible metal-clad cable so as to prevent any possible strain or stress developing in the component parts of the installation.

It is recommended that each circuit have a separate transformer relay control and standard low-voltage air-actuated thermostat operating on a ½-degree differential, thereby providing temperature flexibility throughout the house while maintaining precise levels of comfort for each room.

When designing systems using these

panels, *design* temperature is taken as the *lowest* temperature ever recorded by the local Weather Bureau *plus 15 degrees F.* Where design temperatures are zero or higher, panels should cover at least 55% of all ceiling and, for each 5-degree drop in design temperature, ceiling coverage should be increased 5%.

A rough estimate of the annual kwh consumption of any house may be obtained by multiplying the cubical capacity of the house by 0.3 and by the deg. days of the locality, then dividing the product by 1000. In New York City (5300 deg. days) the annual consumption for a 6000 cu. ft. home would therefore be 9540 kwh and the annual heating charge (at $.02 per kwh) around $190.

The *exact* consumption, of course, would depend upon the type and thoroughness of insulation, the amount of glass area involved and the exposure of the house.

High Pressure Laminates

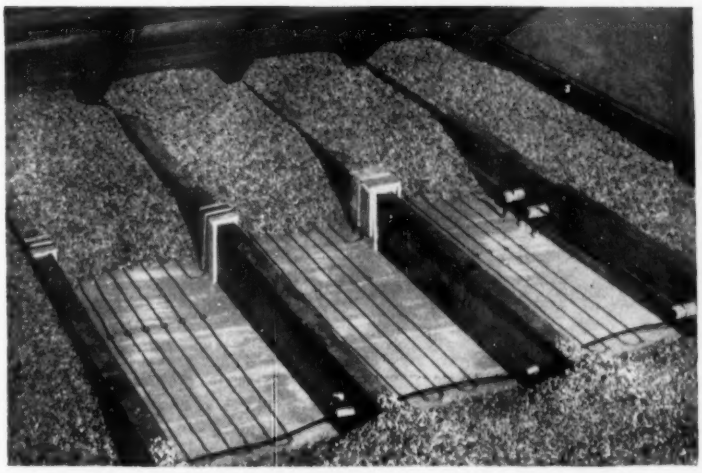
Radiant heating panels of a different design, developed by General Electric, consist of aluminum-covered phenolic high-pressure laminates in which are sandwiched copper alloy wire elements. These panels are 17½-inches wide and can be obtained in lengths of 46, 58 and 70 inches with total wattage ratings of 120, 150 and 180 watts respectively. Wattage density is 21 w/sf and operation is at 230 volts.

Panels are wafer thin—only .04 inch—and may be attached directly to plaster, sheetrock or insulated plywood by means of a plastic mastic in tape form which is moistened with a special activator. After panels are pressed into position, the entire ceiling may be painted and a suitable wood molding may be run around the room to contribute to the overall appearance of the installation. Surface temperature of the panel is approximately 112 degrees F.

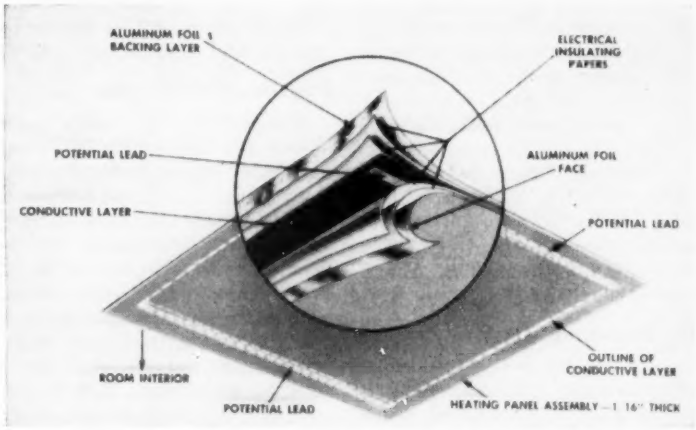
The aluminum sheathing provides a suitable ground for the heating system, and each panel is equipped with an assembled raceway section and terminal block for power connections.

Advantages

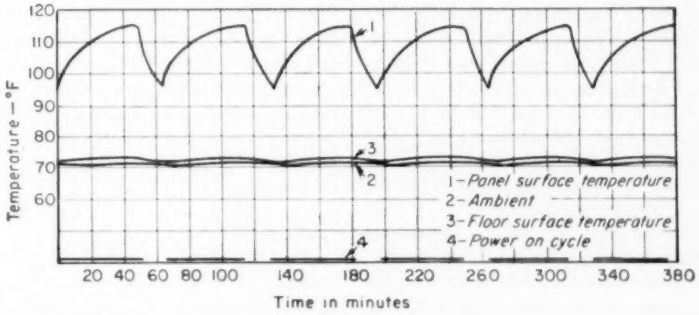
As indicated by these examples, radiant heating may be had at reasonable operating charges in areas where power is relatively inexpensive and



PLASTIC COATED RESISTANCE WIRES may be embedded in ceilings between joists, stapled to plasterboard and covered with insulation blanket such as granular magnesite.

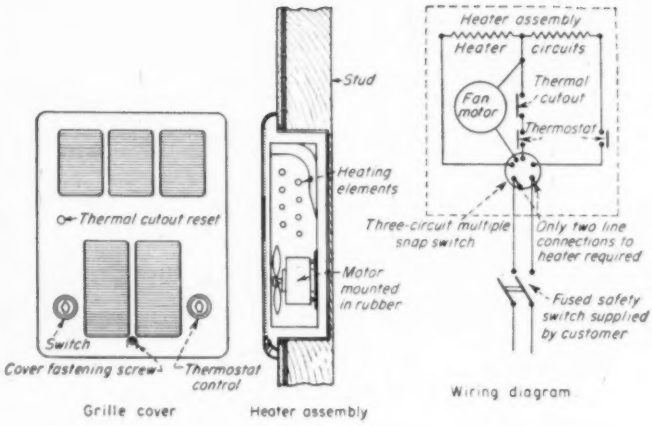


CONDUCTIVE RUBBER, sandwiched between thin layers of plastic and aluminum foil, and backed by stiff asbestos board, may be obtained with ratings of either 17 or 22 watts per sq. ft.



THERMOSTATIC CONTROLS maintain ambient temperature in room within precise range of ½-degree although power cycle and heat of panel surfaces may vary widely.

RADIANT GLASS PANELS may be obtained for baseboard or wall mounting. Output may be regulated by dial or master thermostatic control.



UNIT HEATERS, with radiant heating elements, reflector, air circulation fan, thermostat and fused safety switch, provide fast, silent, clean heat for such locations as bathrooms, breakfast nooks and nurseries.

climates are not severe. But in other areas as well it is receiving favorable acceptance since the higher operating charges are offset by lower installation charges and such intangibles as greater comfort and better health.

Several advantages make it unique in the heating field. For example; since conventional radiators are absent, furniture arrangements in the home are unlimited. And, with room temperatures individually controlled by wall-mounted switches and thermostats, precise degrees of warmth can be maintained within ½ degrees. With central steam systems this feature would be impractical.

Heat Resistant Glass

In any discussion on residential heating mediums, mention should be made of *glass heating panels* which may be surface mounted beneath windows or recessed into walls.

These panels are compact, attractive in design, and consists of clear heat-resistant glass to which is fused various types of resistance grids. Units are assembled with sturdy frames, heat reflecting backings and insulated housings. Operating temperatures are relatively higher than ceiling panels so, although most of the heat delivered to the room is radiant, there is an additional convection component added to the surrounding air.

Similar glass panels encased in steel frames may also be installed around rooms in place of ordinary baseboards. These panels measure from 30 to 42 inches in length, are approximately 6 inches in height and are backed by aluminum reflecting sheets. Back surfaces of the glass contain chemical elements which are literally fused into the glass. In old construction, panels are generally surface mounted, while new construction usually suggests recessed installations. Surface temperatures reach approximately 240° F.

Built-in Unit Heaters

Whether or not homes are centrally heated by fuel-consuming systems, there is a definite market for built-in electric unit radiant or hot air *wall heaters* for bathrooms, nurseries, breakfast nooks, bedrooms and locations where local warmth is desirable. With fast response, high efficiency, quiet operation, safe construction, low operating cost and automatic temperature control features, these built-in units quickly remove chill.

Many modern units are so designed that heating elements are completely shielded, and the inclusion of a built-in fan will draw air from the room, move it through the heating area, then recirculate warmed air back into the room. Switches and dials on the fronts of these units make it possible to select many combinations of heating and blowing levels, or self-contained thermostats may be specified whereby temperature is automatically maintained over an operating range of from 55 to 85 degrees F.

Heat Pumps

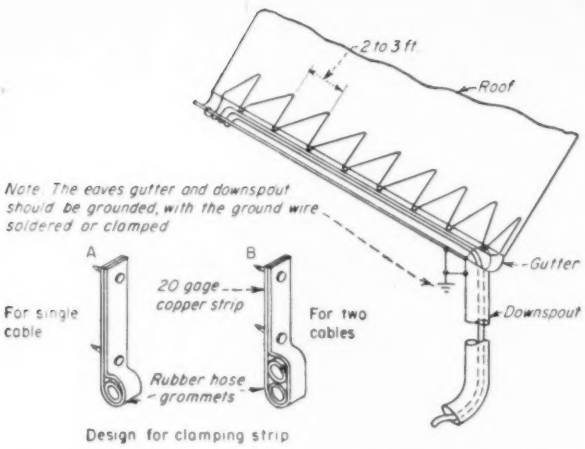
The forementioned systems have potentially tremendous futures, and radiant heating may well be the preferred method by which tomorrow's homes will be warmed. Yet this coming era has another fundamentally new heating possibility, because *heat pumps* are also receiving prominent attention.

These devices provide winter space heating *plus* summer cooling from the same equipment. Energy costs are comparable with solid or liquid fuels now in common use, and controls are available to handle the operation and changeover of the pumps automatically.

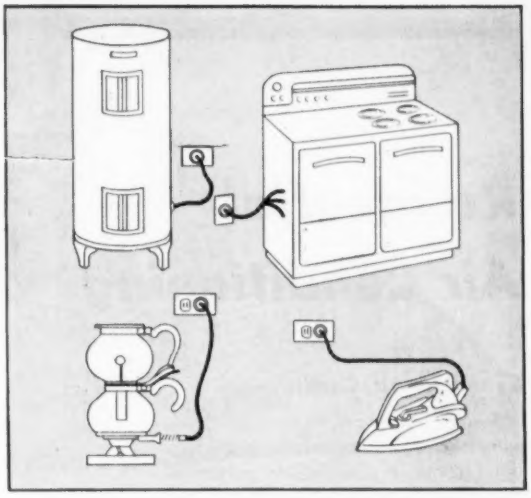
In principle, heat pumps work substantially like refrigerators or unit air conditioners, yet are designed to use *either* end of the refrigeration cycle. In this manner, cold evaporator coils can *absorb* heat from the air for summer cooling, while hot condenser coils *give up* heat for winter heating. Practical applications are still complicated and extensive use of heat pumps is not evident *at present*, since their installation is expensive when compared to other more conventional types of automatic *heating* systems. Yet, when the additional cost of full *summer cooling* is simultaneously considered, the heat pump is *not* a prohibitive possibility and hundreds of installations—some in satisfactory use for two decades—have proved to be sound investments.

Electric Water Heaters

Closely allied to residential heating is the subject of *domestic hot water*. Here, also, electric equipment is finding wide acceptance. Since heaters are rated up to 5-kw or more at 230 volts and since voltage drop must be minimized to insure rated output, heater circuits are generally Number 12 or 10 AWG. In addition, due to special rate schedules made available



HEATING CABLE, when installed in triangular patterns above gutters, prevent formation of ice, development of roof leaks or damage to eaves. Copper straps hold cable securely.



HEATING APPLIANCES, both major and minor, must be translated into such terms as heavier wiring, extra circuits, special outlets and additional switchgear.

to users of electric water heaters, a heater circuit will usually require a separate meter and 2-pole main breaker.

Advantages of electric heaters are many. First, they are fully automatic; giving plenty of hot water for dishes, laundry, baths and showers. Second, they are safe; producing neither fumes nor odors. Third, they are clean; with no flues, soot or smoke to worry about. Fourth, they are convenient, requiring no attention or work. And fifth, they cover a wide range of capacities; making it possible to quickly select the size best suited for any family group.

Both vertical and table-top models are on the market, so a single unit may be installed in a central location to serve the entire home or one or more smaller units may be installed in kitchens, laundries or other water load centers. This latter arrangement, made possible with table-top models, eliminates long pipe runs and minimizes chilling.

Units are fitted with direct-contact Nichrome heating elements; Nichrome wires being embedded in magnesium oxide sealed in seamless copper tubing that projects directly into the water. Current is turned on and off by automatic thermostatic controls. Tanks are welded-seam steel, hot dipped galvanized, with insulating blankets of fiber glass and outer enameled steel enclosures. Corrosion and rusting inside the tank is retarded through the installation of twin magnesium anodes which are mounted on internal brackets and, by electrolytic action, maintain a protective coating on the inner surfaces of the heater tank.

Heating Cable

Heating cable is finding numerous applications for preventing the formation of ice or snow on roofs, outside steps, sidewalks and driveways; warming flagstone terraces to permit comfortable late Fall or early Spring outdoor entertaining; heating greenhouses, hotbeds and solariums for faster plant growth and seed germination, and preventing the freezing of exposed water pipes.

This synthetic- or lead-sheathed insulated resistance cable may be purchased on bulk reels or obtained as precut pre-connected assemblies with ends brought together in a plug which may be inserted into any convenience outlet. Due to its flexibility, the cable may be bent sharply and laid in closely-spaced hairpin arrangements to build up heating intensities as desired.

Operating voltages for residences generally are either 115- or 230-volts and control may be manual or automatic; the latter method utilizing thermostats mounted on a convenient wall, strapped directly to a pipe or buried in the soil being heated. When manually operated, heat is produced only when needed.

To prevent ice from forming on roofs, cable is installed along the eaves in a triangular pattern, with peaks several inches higher than the intersection line of the sloping roof with vertical house walls. Cable can be attached by copper straps fitted with rubber grommets. To prevent leaks around nails, roofing compound is also recommended. Metal gutters and downspouts should be grounded to prevent shock in case insulation becomes damaged. One standard pre-cut 80-foot 115-volt 400-watt loop of cable will protect approximately 23 linear feet of roof.

A similar length of cable will heat approximately 50 square feet of soil in a hotbed.

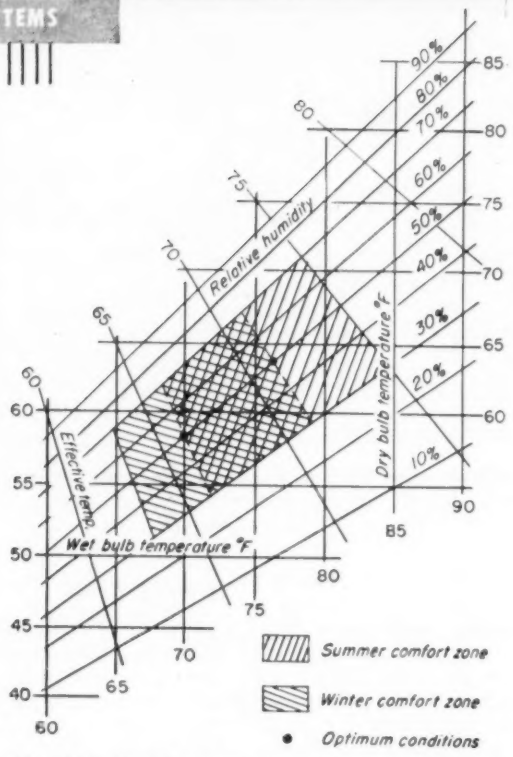
Other Heating Appliances

With new residences going up at the approximate rate of a million units a year, and with countless older homes modernizing to provide electrical facilities to serve appliances of modern living, many contractors are concentrating on this lucrative market. Builders, also, are learning that prospective owners, when properly informed of the many ways electricity can improve the comfort, convenience or safety of a home, *will* pay premium prices to obtain an adequately wired residence. They are finally discovering that no other single factor improves the salability of a house to a greater extent than electrical conveniences.

While all of the forementioned heating agents are *permanently wired*, we should not overlook heating devices which are *plugged into convenience outlets*. This list includes such items as electric ranges, ironers, clothes dryers, hand and soldering irons, toasters and roasters, sandwich and waffle grills, coffee makers, portable space heaters, bed blankets, heating pads, bottle warmers, curling irons and hair dryers, heat and sun lamps.

Sufficient 20-amp branch circuits must be provided to adequately serve this sizable heating load.

Residential Air Conditioning



COMFORT CHART indicates that optimum summer conditions exist when mildly circulating air is at an effective temperature of 71 degrees F with RH at 50 percent.

Complete Air Conditioning

Practically every American home owner already is practicing some partial form of residential *air conditioning;* defined by the ASHVE as "the process of maintaining within required limits the temperature, moisture content, movement and quality of air." At present relatively few homes claim *all* of these objectives yet nearly all utilize *some* types of equipment to obtain one or more of the components. Equipment sales in this field are showing steady growth, both in volume and diversity, so it becomes imperative for electrical contractors to anticipate and *promote* adequate outlets, circuits, wiring and protection not only for complete central air conditioning units, but for such items as individual room coolers, electrostatic air cleaners, air blenders, large attic fans for comfort cooling, conventional portable fans and kitchen or bathroom exhausts.

Complete air conditioning controls temperature, humidity and motion of the air. It also regulates air distribution and removes dust, bacteria, tobacco smoke and cooking odors from the atmosphere. Cleaning the air prior to circulation is also desirable to remove air borne dirt and irritating pollens and dust.

Summer comfort for humans lies between a dry bulb temperature of 68 degrees with 70% relative humidity, and 85 degrees with a 30% RH. In striving for this range, air conditioning designers calculate their loads by considering outside weather conditions, the relation between wet and dry bulbs, natural air motion, solar radiation, structural features and geographical location.

Standardized Unit Assemblies

Considering these factors and designing each installation to exactly satisfy each set of requirements would naturally result in an infinite number of models. To secure the advantages of mass production, however, manufacturers limit their lines to a relatively small number of units, each model covering a fairly wide range of capacities. Performance, therefore, is understandably a compromise between exact requirements and standardized capacities. But this is not objectionable, because the price of a slightly larger-than-required unit is not excessive, and a larger unit provides for unexpected or abnormal conditions. It also precludes overloading the equipment and the circuit wiring behind it.

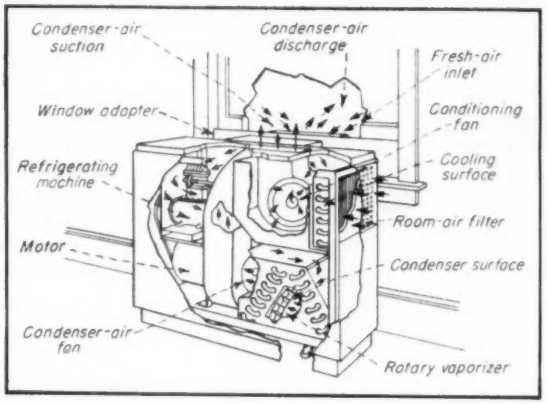
Factory assembled units, enclosed in sheet steel casings having removable access panels, include in a single package the blowers for air movement, filters, refrigeration compressors, cooling or dehumidifying coils, and air or water condenser coils.

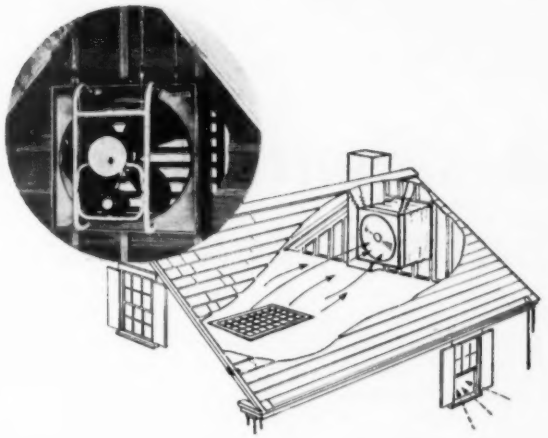
Attic Ventilation

In every section of the country Weather Bureau statistics show that average summer *night time* temperatures range from 15 to 31 degrees below day time maximums. Statistics also prove that daytime maximums may be *exceeded* by 25 to 40 degrees in unventilated attics beneath unshaded and uninsulated roofs. This blanket of stored-up heat radiates downward into the house long after sunset unless some mechanical means is provided for expelling the hot air.

Comfort cooling, a system whereby this hot attic air is quickly expelled, becomes possible by installing a large bladed (24 to 60 inch) slow moving (230 to 650 rpm) fractional hp ($\frac{1}{4}$ to $\frac{3}{4}$) belt-driven fan beneath the roof. Besides dissipating the reservoirs of heat, these fans also draw cooler night air into the house through open doors and windows. Comfortable air is thereby circulated throughout the house and it becomes possible for home owners to relax in comfort. During the evening and night, the rate of air change may be regulated either by motor control or by closing windows in rooms where cooling is not essential.

Remote control, using either conventional 115-volt wiring or low-voltage relays for the purpose, makes it possible to operate the fan from any desired point in the home and, by installing a fusible link in the plenum

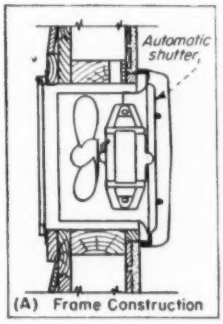


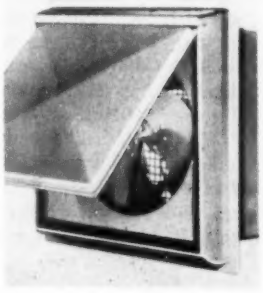


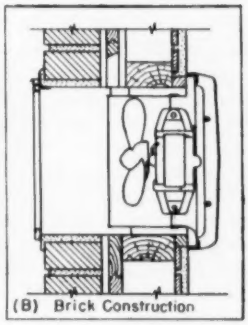
UNIT AIR CONDITIONERS are factory-assembled with cooling and dehumidifying coils, blowers, motors and filters in insulated enclosures. (Above)

COMFORT COOLING is obtained by installing a relatively slow-moving large-bladed fan in the attic, thereby expelling hot air and drawing cool air into the home. (Upper right)

EXHAUST FANS to remove heat and odors from kitchens can be mounted in cabinets incorporated directly in exterior walls. Outside shutters automatically open and close. (Right)







chamber or stair well leading to the attic, automatic cut-off in case of fire may be provided for, guaranteeing insurance to the home owner.

Operating costs are simply those charges resulting from running the fan motor. In Dallas, Texas, for example, a 10,000 cfm fan operating 7 hours a day from May to October used 330 kwh per season. At $.02 per kwh this would result in a seasonal charge of $6.60—considerably less than a cent an hour for this desirable comfort cooling. In other sections of the country the charge would be less.

Room Fans

When it is neither possible nor feasible to install high capacity fans to cool an entire house, fresh air may be introduced to individual rooms, and odors or heat may be exhausted from kitchens, laundries or baths by means of local ventilation or exhaust units.

Some window units have reversible fans so that warm air may be expelled during the day and cool air drawn into the room after sundown. In operating these fans as *exhaust* units it is recommended that only the window furthest from the fan be opened, thereby insuring maximum circulation of air within the room.

Typical window fans average from 16 to 24 inches in diameter, are equipped with from 3 to 6 overlapping blades and are driven by motors rated from 1/3-hp down to about 1/25th. Adjustable panels permit their use in windows of any width and flexible cords permit their connection to any convenient receptacle. Fans may be single, dual or multi-speed, with blade speeds between 300 and 1000 rpm and air capacities between 600 and 6000 cfm. Attractive cabinets and quiet, vibrationless operation make them desirable in any location.

Exhaust fans may also be mounted in sleeves or cabinets installed directly in other walls of kitchens or similar areas. These units are equipped with outside shutters operating conjunctionally with the fans and closing automatically when motors are not running. A typical 10-inch kitchen wall-piercing fan is rated at about 60 watts; has a volume of 500 cfm.

Electrostatic Air Cleaning

Electrostatic cleaners, when placed within the path of the air intake to a central air conditioning unit, will remove more than 90% of *all* particles in the air, and 99% of the *dirt* by weight. This is done economically, silently and without any moving parts. The result is definitely healthful to all and it provides positive relief to those suffering from hay fever or asthma. It also lessens the chore of cleaning draperies, furniture, walls and ceilings.

Operation is based on the fundamental electrical concept that bodies of unlike charge attract each other. Dirt particles in the air stream are therefore given an electrical charge as they pass through an ionizer, and they are trapped in dust collector cells having plate surfaces of opposite polarity.

Power input to these units is 115-volt single-phase ac. By means of a voltage-doubling rectifier circuit this input is amplified and rectified to steady high-voltage dc, thereby supplying 6-kv dc for collector cells and 13-kv dc for the ionizer.

Residential Lighting Enters New Era

A NEW concept of lighting for residences is emerging. Its acceptance and adoption is slow, but sure. Basically, it embraces the principle of providing both general and local lighting from built-in, recessed, and fixed types of lighting units artistically and functionally integrated with the architectural and decorative treatment of the house. One architect aptly defined this principle as "lighting that which you see and not seeing that which does the lighting".

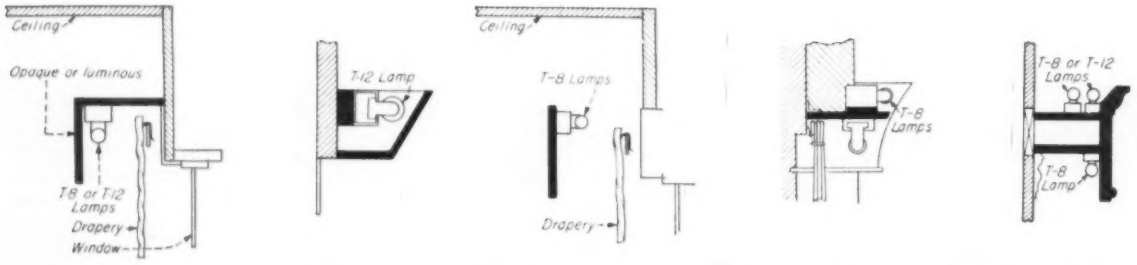
This new lighting concept requires the coordination of the lighting with living habits, building structural details, materials, and furnishings. It eliminates the traditional concept of a lighting "fixture" exposed within the room area, and incorporates the lighting element in the structure of the house itself. It is equally applicable to all types of architecture—modern, ranch house, or traditional.

Residential lighting "fixture" designs have gone through various stages of change. Architects, interior decorators and equipment designers have run the gamut of designs and ornamentation. Some of these have been excellent examples of true period reproductions and skilled craftmanship in metals, glass and materials. But in the main they have been horrible examples of rococo design, florid and ornate, without rhyme or reason. With the advent of the modern design technique in the past several years, residential lighting fixtures have been streamlined, and much of the ornateness has been removed. However, more attention has been given consistently to the design of the fixtures and to their eye appeal than to their ability to provide comfortable lighting of the quality and quantity needed and desired. Both are important qualities to be achieved.

Requests for improved home lighting have been increasing over the past several years. People who work, study and play under new and improved standards for lighting in factories, offices, stores, schools and places of

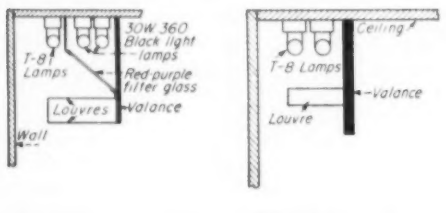
A FLUORESCENT STRIP LIGHTING

VALANCE LIGHTING



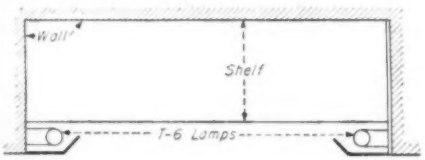
1 Direct Single-Lamp | 2 Indirect Single-Lamp | 3 Direct — Indirect Single-Lamp | 4 Direct — Indirect Two-Lamp | 5 Direct — Indirect Three-Lamp

CORNICE LIGHTING



12 Fluorescent Wall Mural | 13 Wall Lighting | 14 Recess Bed Lighting

NICHE LIGHTING



15 Plan Section

recreation demand better lighting in their homes. Since these homes are becoming smaller, better home lighting becomes economically justifiable, as the total area to be lighted is smaller.

The new concept for home lighting was first adopted in the original all-electric kitchens back in the 1930's. Here recessed lighting was used over the kitchen sink. Then with the advent of fluorescent lamps, under-cabinet lighting made its appearance. Next the fluorescent luminaire was installed on the center ceiling outlet.

With these improvements in lighting in the kitchen, home owners began to demand improved lighting in other areas throughout the house. This brought about valance lighting over windows, then along interior walls, and over the head of the bed. Next was the demand for illuminated wall niches and book cases, then for indirect lighting from coves and for many types of special applications.

Along with the increased use of the fluorescent lamp for lighting in the home has been an increasing demand for recessed and built-in types of incandescent lighting. These units have been used principally to provide focal glow highlights, to supplement the general area lighting from fluorescent lamps, and for many specialized applications where accurate light control is desired.

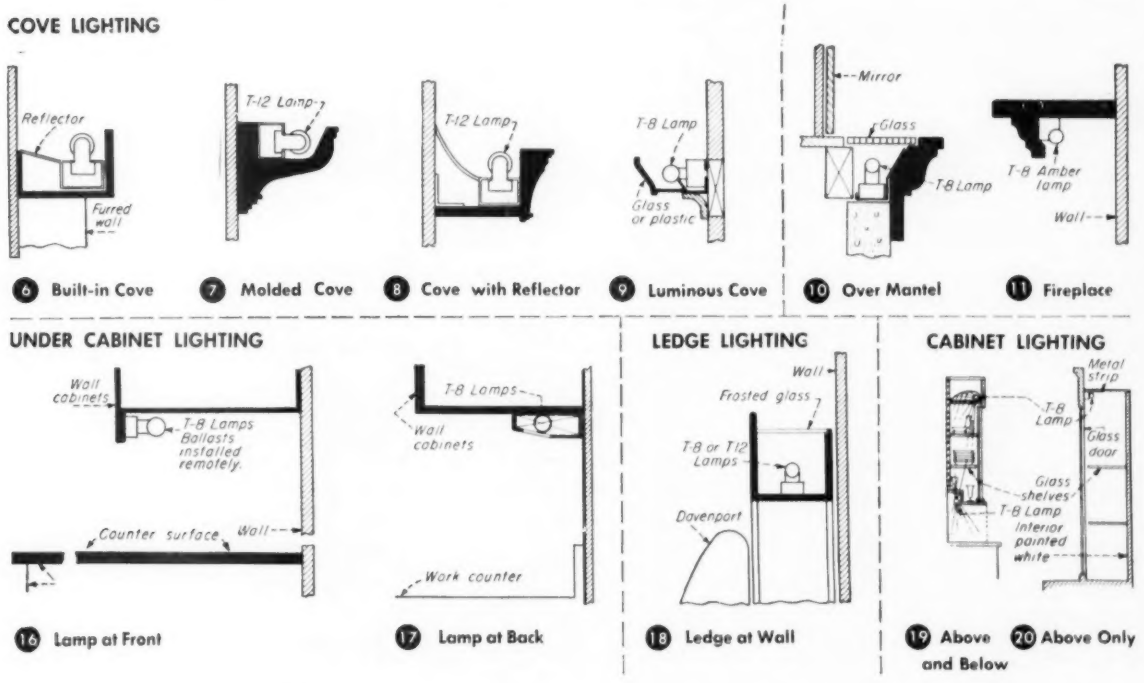
While the use of these new developments in home lighting has been limited, the increasing demand nevertheless exists. This new concept of home lighting is sound. It conforms with the principles of good home light conditioning practice. It is appropriate for houses of contemporary or traditional design, and for modern or traditional interiors. It represents the beginning of a new era.

Lighting Flexibility Needed

It is not intended to infer here that built-in, recessed, or concealed lighting is a panacea for all home lighting needs. It is not so recommended, even though this is now possible and economically justifiable. People vary in temperament, in psychological reactions, and emotionally. Versatility and variety in lighting, from one home to another, and even in the same home, is desirable. Today's typical family carries on a wide range of activities within the confines of the home. These include cooking, eating, sleeping, dressing, bathing, shaving, entertaining, playing, drinking, watching television, listening to radio and music, conversing, reading, writing, serving, studying, laundering, ironing, working at hobbies, dancing, and many others.

Such a wide variety of activities requires maximum flexibility in the lighting system. It also requires a variety of lighting effects, to create the proper mood or environment for each activity, and for the mood and temperament of the occupants. Thus there is no one single solution, no one typical luminaire that will provide the flexibility required. Rather it is desirable that a variety of lighting techniques be employed, with maximum flexibility of switch control, so that the widest possible range of lighting effects are available at the flip of the switches. This is especially true for the living room, dining room, bedroom, and recreational or playroom areas.

Individual preferences of home owners will maintain a continued demand for the typical period design and stylized residential lighting luminaires and portable floor and table lamps. These preferences are sincere, because the mass consumer market for residential lighting, including most architects and interior decorators, has been



educated to use these types of lighting devices. Furthermore, well established trade distribution channels make these lighting designs readily available to home owners everywhere.

It is pertinent to note, however, that many home owners are now demanding concealed and built-in lighting. They like it. It eliminates the rapid obsolescence of "style" luminaire designs. It eliminates the inconvenience and safety hazard of portable cords used on floor and table lamps, and of cluttering up needed floor space with floor lamps. It takes the added heat of lamp sources out of the room, contributing to greater comfort in hot weather. The trend is to concealed lighting. A wide variey of equipments and techniques are now available, and their use in homes is increasing. Many are shown in the accompanying illustrations. Alert and imaginative architects, designers and decorators will improve and broaden the scope of application of these techniques. Further research and technological developments on these techniques within the residential lighting industry can result in the rapid attainment of greatly improved visibility, comfort, and decorative treatment for the home owners who use them.

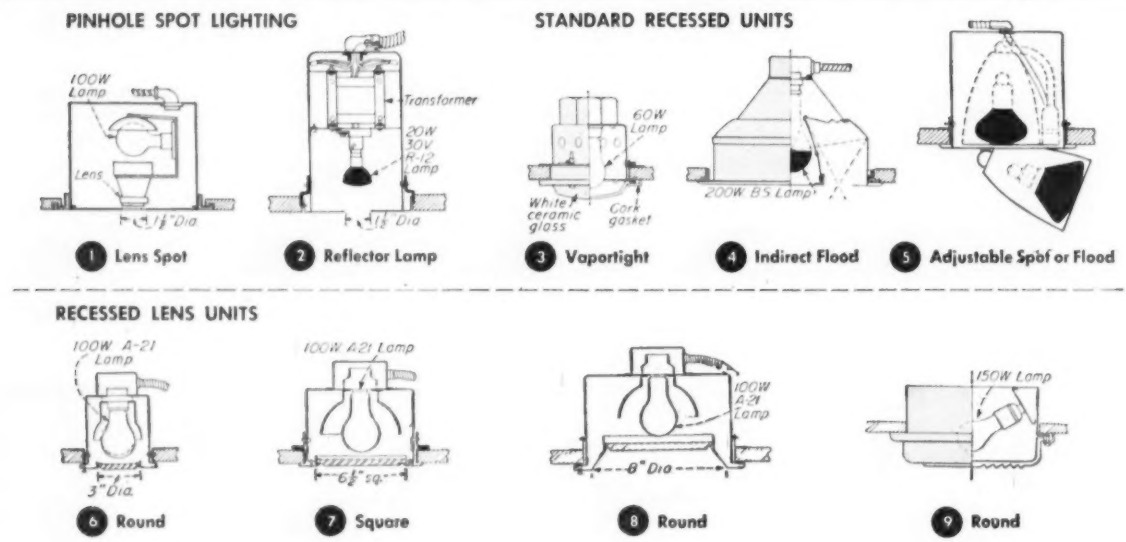
Light's Function in the Home

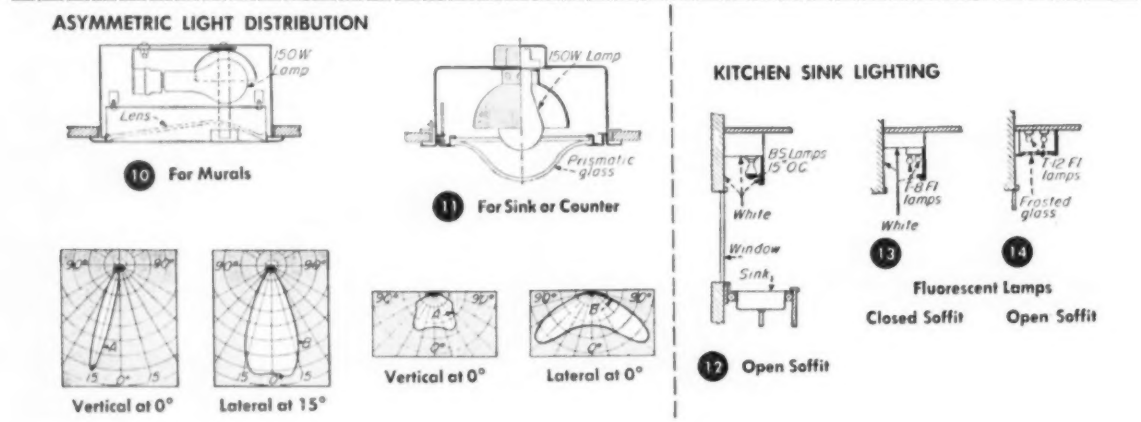
The principal purpose for lighting in the home is to provide comfortable seeing for work, play and relaxation. But it also serves many other needs. It must also enhance the spirit, the atmosphere, and the decorative treatment that transforms a house into a home. It must create a sunny and cheerful environment, which is also a requisite for comfortable seeing. It should be flexible to permit a wide variation in lighting effects to fit varying moods, and in psychological and decorative value.

The lighting environment extends beyond and is influenced by more than just the lighting system. It includes the walls, ceilings, floors and furnishings. These areas reflect light and cause rooms to appear larger, more cheerful, more colorful, more livable, when medium to light finishes are used. Dark finishes have the opposite effect.

The broad range of light sources, lighting techniques and lighting units makes it possible to select lighting systems which fit family budgets, yet remain appropriate for varying decorative treatments for individual family habits and requirements. When combined with appropriately finished light colors on all interior surfaces, a more satisfactory lighting environment may be expected.

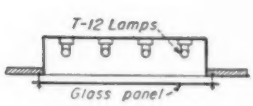
B CEILING RECESSED INCANDESCENT LIGHTING



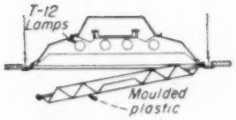


C CEILING RECESSED FLUORESCENT LIGHTING

GENERAL LIGHTING



1 Glass Panel

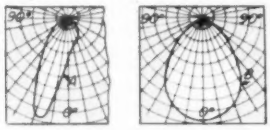


2 Plastic Panel

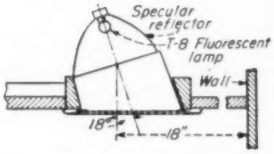
3 Prismatic Lens

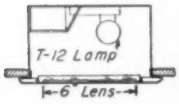
4 Troffer

MURAL OR WALL LIGHTING



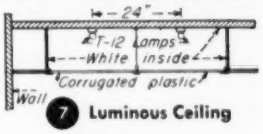
Vertical at 0° Lateral at 15°



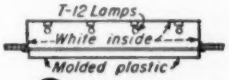


5 Lens Control 6 Reflector Control

LARGE AREA PANEL LIGHTING



7 Luminous Ceiling



8 Luminous Panel

Living Room Lighting

There are two fundamental requirements for lighting a living room, from the lighting viewpoint only. These are provision for an abundance of general illumination throughout the entire room, and provision for a high level of local lighting at all furniture groupings, or local areas where difficult seeing problems exist. The methods available for providing these two types of lighting are many, and there are practically unlimited possibilities for the further use of light for decoration, safety, utility and otherwise to suit the whims and fancies of the most exacting home owner.

General room illumination can be provided effectively by window and wall valance lighting (Sketches A1 to A5), by cove lighting (Sketches A6 to A9), by a large area ceiling unit, by indirect wall brackets, and by open top floor and table lamps. High level local lighting can be provided by ceiling recessed spot or flood type incandescent units (Sketches B5 to B9), or by floor, table and desk lamps. For wall located furniture, such as desks or davenports, wall valances (Sketch A13) and wall brackets can be used.

There are innumerable special lighting techniques applicable to the living room area. Breakfront cabinets can be lightend by concealing small diameter fluorescent lamps within the cabinets. The mantel can be used to conceal fluorescent lamps for lighting the fireplace, or for lighting a mural or painting over the mantel (Sketches A10 and A11). Wall niches can be self-lighted (Sketch A15). Luminous paint murals can be effectively lighted by black-light lamps as well as by standard fluorescent lamps (Sketch A12). Portable lighted ornaments can be used throughout the room, for use with subdued lighting. And it is good practice to install a wall-recessed night light (Sketches D3, D4) at the door, which should be kept burning at all times. There are many other similar applications which the enterprising home owner will want, according to furniture arrangement, living habits, and decorative treatment.

Highly important is an arrangement for full flexibility of control of all lighting in the room. Where cove lighting is used, or fine gradations of lighting effects are desired, dimmer equipment should be considered. Such equipment is now available for fluorescent lighting. Separate switch control should be used for individual lighting elements to provide full flexibility.

In using valances, these should extend across the entire window wall, and for a balanced lighting effect, a similar wall valance should be used on the opposite wall. Valances are now commercially available, either with or without the shielding unit or the traverse rod for windows. The shielding units are also available in opaque or luminous types. Opaque types can be painted, covered with wall paper or the same material as the draperies, and are sufficiently flexible of design to fit either the traditional or modern decorative treatment.

If ceiling-recessed local lighting units are used, these should be carefully located in the ceiling acording to the location of davenports, easy chairs, desks, or tables where the local lighting is desired.

Pictures, murals and wall statuary can be effectively illuminated by several types of ceiling-recessed asymmetric light distribution type of units (Sketches B1, B2, C5, C6). Optical assembly type pinhole spots are available for installing at an angle in the ceiling, which have a shutter arrangement for accurately confining the light beam to the picture of piece of statuary. Pinhole spots are also useful in highlighting flower arrangements on a table, or decorative ornaments placed about the room.

All floor and table lamps should be equipped with two-filament lamps to provide three lighting intensities.

Dining Room Lighting

The trend to smaller homes, and to simplified living without servants, has fostered the combining of living and dining areas. Where this trend is followed, the lighting of the dining area must logically conform to the lighting treatment in the living room.

Usually this is not difficult to achieve. If valance or cove lighting is used in the living room, it can be ex-

tended to the dining area. If floor and table lamps are used for general lighting in the living area, indirect wall brackets, or cove or valance lighting can be applied in the dining area.

Lighting requirements for the dining room are for general diffuse lighting and for accent lighting of the dining table. For the accent lighting a pendant ceiling fixture can be used. Some types are adjustable, can be pulled down near the table for dining, recoiled to the ceiling after the meal.

Concealed lighting may also be used in the dining room. Large luminous panels (Sketches C1, C2, C7, C8) can be centered over the dining table for general diffuse lighting, or a typical recessed flood type unit (Sketches B4, B8) can be used. This type unit can also be supplemented by two recessed pinhole spot lights, one over each half of the table (Sketches B1, B2). The use of pinhole spot lights only is not recommended without some other means of providing a low intensity of general illumination in the area, as the directional quality of the spot lights only casts sharp facial shadows and is usually too harsh.

Wall cabinets, wall niches, paintings and murals in the dining room or dining area may also be lighted. Techniques for lighting these areas are described above under "Living Room Lighting". Flexibility of lighting control is equally desirable in the dining room as in the living room, and light finishes of ceiling, walls, furniture and furnishings are equally important.

Kitchen Lighting

Lighting requirements in the kitchen are for a general lighting intensity of from 10 to 20 footcandles throughout, with supplementary lighting over all works areas—food preparation, cooking and dishwashing centers. General lighting should be provided by a center ceiling unit. This may be a surface-mounted diffusing type unit, or preferably a recessed or semi-recessed large area unit (C2, C3, C4, C7, C8).

Under-cabinet lighting provides excellent illumination on work counters (Sketches A16, A17), and kitchen sinks can be lighted ideally by incandescent or fluorescent lamps concealed in a soffit over the sink, (Sketches B11 to B14).

Ranges can be lighted by wall brackets using fluorescent lamps, or by ceiling-recessed incandescent units (Sketches B7, B8) located directly over the range.

Luminous clock faces and lights within cabinets which turn on when the doors open, similar to built-in refrigerator lights, are innovations available for the home owner who may desire them.

Bath Room Lighting

Regardless of the size of a bathroom, an overhead ceiling mounted unit is recommended. In addition, the bathroom mirror should be provided with lighting. Extensive tests and experiments indicate that shaving presents the toughest seeing problem in the bathroom; hence, mirror lighting which proves satisfactory for shaving, will satisfy all other seeing problems in this area. These tests with varying lighting combinations of units over the mirror and with shielded and unshielded brackets on either side of the mirror indicate that two side brackets approximately 20 inches long each, with glass or plastic shields which reduce the brightness to about 1.8 candles per square inch, installed one on each side of the mirror provide the best results most economically. These brackets should be installed with their centers about 5 feet 2 inches from the floor, 4 inches lower than common practice. Flush glass panels on either side of the mirror, with 20-watt fluorescent lamps behind the glass, provide comparable results.

Another bathroom mirror lighting technique which provides equally satisfactory results is that of concealing fluorescent lamps in a curved recess on both sides and top of the mirror, and painting the curved reflecting surface a pale pink, flat finish. While usually more expensive, this creates a more flattering color effect, and is ideal for applying makeup.

Recessed shower stalls can be lighted by ceiling mounted vapor-tight units, either recessed or surface installed (Sketch B3).

Bedroom Lighting

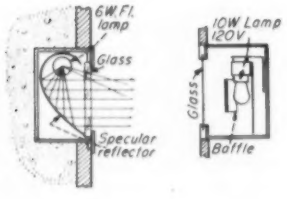
Center ceiling lights are desirable in the bedroom as a matter of convenience in providing overall general lighting for room cleaning, making up the bed, and for dressing. Shallow surface mounted units are most generally applicable, but these units could also be recessed large panel diffusing units.

For those who like to read in bed, lighting should be provided for this purpose. Built-in types (Sketch A14) of cornice lighting, or surface mounted wall brackets (Sketches E2, E3) are best for this purpose.

Lighting for the vanity and dressing table mirror requires a low brightness unit on each side of the mirror, centered at about face height for the per-

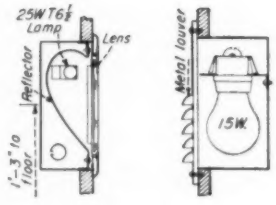
D WALL RECESSED LIGHTING

LUMINOUS HOUSE NUMBERS



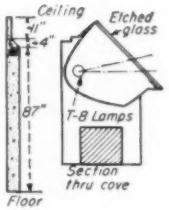
1 Fluorescent 2 Incandescent

NIGHT LIGHTS



3 Lens Control 4 Louver Control

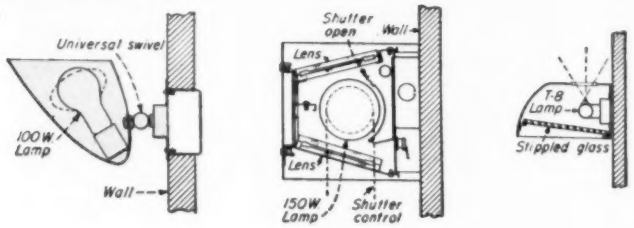
COVE LIGHTING



5 Built-In

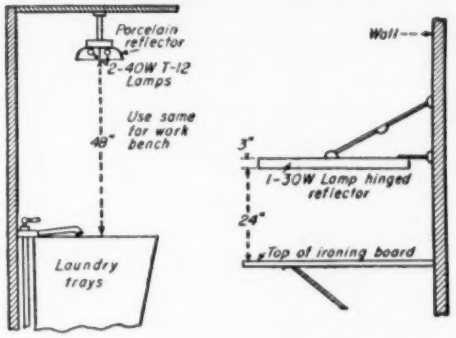
E WALL BRACKET LIGHTING

SPECIAL APPLICATIONS



1 Indirect 2 Incandescent Bed Lamp 3 Fluorescent Bed Lamp

F LAUNDRY LIGHTING



1 Tub or Work Bench 2 Ironing Board

son seated in front of the mirror. These units, usually table lamps with proper type shades, should also permit light to be directed to the ceiling and upper side wall. Recessed, or built-in light panels on each side of the mirror are also appropriate, and eliminate the hazards of using portable lamps.

Where full length mirrors are used in the bedroom or dressing room, recessed low brightness panels extending the full length of the mirror, and on each side, are desirable. Pink finished reflectors, even when concealed by diffusing panels, aid in correcting the color quality of the light produced by fluorescent lamps. This is important to the discriminating lady who wants to be sure her makeup and costume properly harmonize. Use of deluxe warm or cool white fluorescent lamps are recommended for all mirror lighting, depending on individual preferences for the warm versus the cool color. Wall-recessed night lights should be installed near the doorway to the hall and similarly near the doorway to the bathroom.

Hall and Stairs Lighting

It is customary and desirable to use an attractive ornamental type ceiling luminaire in the main entrance hallway. Depending on the budget and the size of the hall, this unit might be an unusual decorator's design, or it may be a period design harmonizing with the house architectural style. If greater simplicity is desired, a recessed or semi-recessed (Sketch B9) unit will be appropriate. Similar semi-recessed glass or plastic units will also be appropriate for upstairs hall and stairway.

A wall-recessed night light (Sketches D3, D4) should be installed in the main doorway, also at the head and foot of the stairs, and at or near the midpoint of the upstairs hall opposite the stairway. These night lights may be of low wattage, and should be kept burning at all times. For houses which do not have an entrance hallway, the night light should be installed in the living room wall near the main entrance doorway.

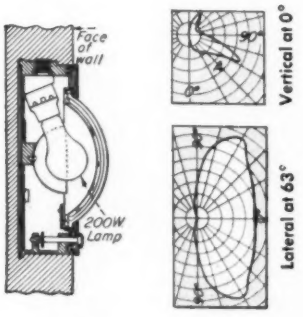
Recreation Room Lighting

The home owner has a real opportunity to show his ingenuity and reflect his hospitality in the lighting of the recreation or playroom. The treatment from a decorative standpoint will depend on the various activities for which the room is planned.

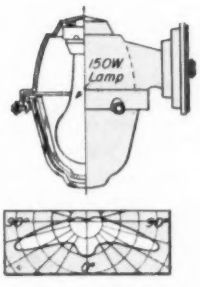
If the recreation room is used for card playing, indirect wall brackets (Sketch E1) or indirect torchieres will produce comfortable illumination free from shadows and glare. These should be used only if the ceiling is light in color, however. Wall valances or built-in coves may also be used. Large area low brightness panels (Sketches C7, C8) centered over the card tables will also be found satisfactory, provided a low level of general lighting is also maintained.

If the recreation room is used for

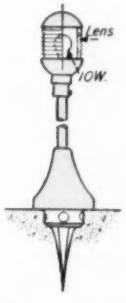
G OUTDOOR LIGHTING



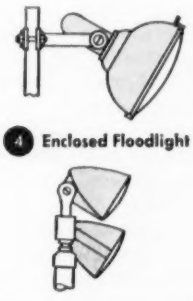
1 Wall Recessed Unit



2 Surface Mounted Bracket



3 Garden Light



4 Enclosed Floodlight 5 Spot or Flood R-Lamp Units

How Much Light is Needed

(Minimum Illumination For Household Activities)

Activity, or Seeking Task	Footcandles
Reading	
Prolonged periods, fine type	40 - 50
Casual periods, books, magazines	20 - 30
Studying	40 - 50
Writing or typewriting	25 - 40
Game Playing	
Cards, general games	10 - 20
Table tennis, recreational	20 - 50
Drafting, or other detail work	50 - 100
Sewing	
Casual, on light goods	20 - 30
Prolonged, on light goods	30 - 50
Prolonged, average sewing	50 - 100
Fine needlework, on dark goods	Over 100
Kitchen work	
General	10 - 20
Sink, range, food preparation center	40 - 50
Dining	
General	5 - 10
If table used for reading or writing	20 - 40
Laundry	
Tubs, ironing board, ironer	40 - 50
Make-Up	
Dressing tables and dressers	20 - 30
Shaving	
Bathroom mirror	30 - 40
Handicrafts, knitting, weaving, etc.	20 - 30
Bench work	30 - 50
General Lighting	
Walking up and down stairs and halls	4 - 8
General circulation in rooms	5 - 10

table tennis, and for such games as archery and darts, provision should be made for high intensity lighting of these areas. For table tennis recessed troffers will be found satisfactory, provided intensities of 40 footcandles or more are provided over the playing area. Adjustable spotlights (Sketch B5) will provide high level lighting for dart boards and archery targets.

When the recreation room is also used for general entertaining, cocktail parties, dancing, television viewing, etc., more subtle lighting is desirable. Wall lighting from recessed asymmetrical light distribution units (Sketches B10, C5, C6), ledge lighting (Sketch A18), and miscellaneous applications of fluorescent strip lighting to the furniture appointments used in the room will be found to be most effective. All types of low brightness ornamental and decorative lighting effects will also be appropriate, reflecting as much as possible the home owner's own individuality.

Lighting Special Rooms

For homes with a library, den, study room, hobby or trophy room there are many ways of providing comfortable lighting through the use of built-in lighting equipment. The same principles of lighting obtain—provide a low level of diffuse general illumination, and supplement this with local lighting from ceiling-recessed units for areas where more critical seeing is required.

Lighting the sewing room, or sewing area, is praticularly important. This area is often a part of the living room, den or recreation room, and provision should be made for intensities up to 100 footcandles and above for the local area where the actual sewing is done.

All closets should be lighted. A simple method is to use a bare lamp in a porcelain lampholder, controlled by a pull switch or door switch. More elaborate lighting can be worked out if desirable.

Laundry Lighting

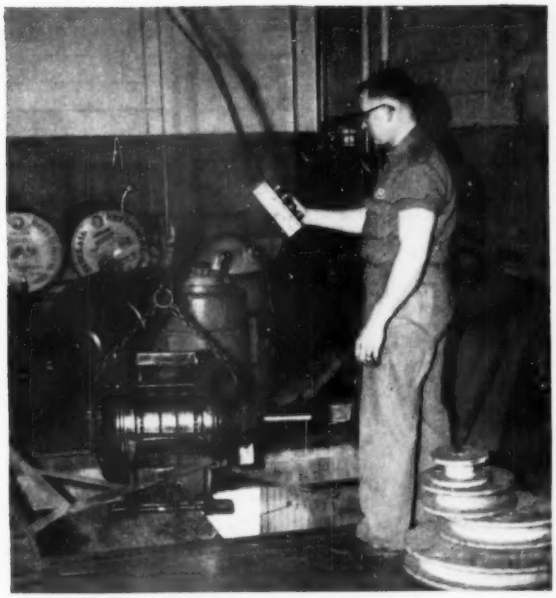
Good lighting is important for the laundry. Sketches F1 and F2 show typical lighting methods. Either fluorescent or incandescent open reflectors equipped with shielding provisions are satisfactory. The same type units are also applicable for lighting the workbench. Incandescent metal reflectors are appropriate for lighting the general utility areas in the laundry or basement, as well as in the garage.

Exterior and Yard Lighting

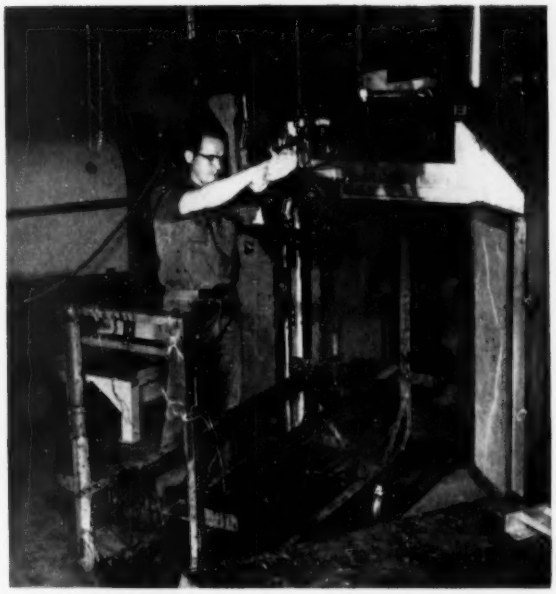
Illuminated house numbers are a great convenience, and a variety of designs are readily available (Sketches D1, D2), for mounting at the front door, on the porch or along the entrance walkway. Two outdoor lantern brackets, one on either side of the door, or a ceiling type porch light should be installed to provide ample light from the sidewalk to the doorway. Step lights are also desirable.

Exterior lighting is desirable for convenience, protection, and outdoor living in the summer. Wall-recessed units (Sketch G1) are available for installing high on the exterior wall, or under the eaves, which have a 180° spread of light out at an angle suitable for lighting the entire yard. A weatherproof wide spread lens bracket installed over the rear door of the house, and over the garage door, will flood these two entrances with needed light for safe egress and entrance.

Other suitable outdoor lighting units for lawns, gardens, walks, patios and similar outdoors areas include weatherproof floodlights (Sketch G4), spot and flood Reflector lamps in cast housings (Sketch G5), and stake lights (Sketch G3). Weatherproof convenience receptacles should be placed at convenient locations on the exterior of the house and garage, to permit the use of special garden lighting in the summer months, and decorative lighting for Halloween, Christmas and other holiday festivities.



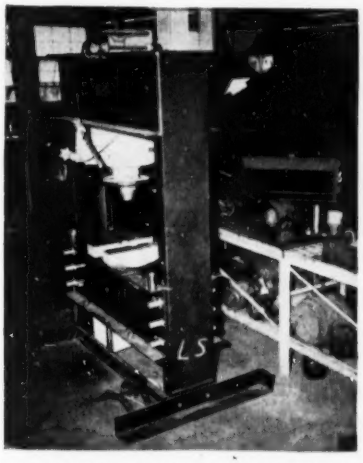
TRAP-DOOR LOADING and unloading of trucks on basement ramp is one innovation. A one-ton electric hoist on bridge crane lifts equipment through a 72-in. by 58-in. floor opening covered by twin steel doors equipped with counter-balanced bracket arms. Small equipment is handled at shop-level.



FOR LOADING EASE, this 20-kw. bake oven is set at an angle to building walls so doors and rack truck line up with overhead monorail hoist. Dip tank is at left, assembly benches at far right. Metallizing lathe and dynamic balancer are in background; 2-kw. oven at right.

Up Goes SHOP EFFICIENCY

. . . at Barker-Fowler Electric Company's new motor shop headquarters in Lansing, Michigan. Overhead cranes and a few new twists on equipment layout did the trick in boosting speed and ease of operations.



TO INCREASE OPERATING FLEXIBILITY of this 125-ton hydraulic arbor press, two extra legs (arrow) of 5-inch angle-iron (each 27 inches long) were added to top of unit.

WHEN increased business began to crowd Barker-Fowler's motor repair department out of its original multi-story quarters, management decided to build a new headquarters specifically designed to promote efficient shop operation. The result is a roomy, well-lighted, radiant-heated, one-story, full-basement structure. In it, shop superintendent Mason V. Green has put into practice many ideas he was unable to use in the old building.

Tops among them is an extensive overhead equipment handling system consisting of bridge cranes and monorail hoists. Hardly a square foot of shop area is inaccessible. In some cases, shop equipment is placed at unconventional angles for better alignment with hoist travel. No repair job need be lifted or moved by brute muscle power.

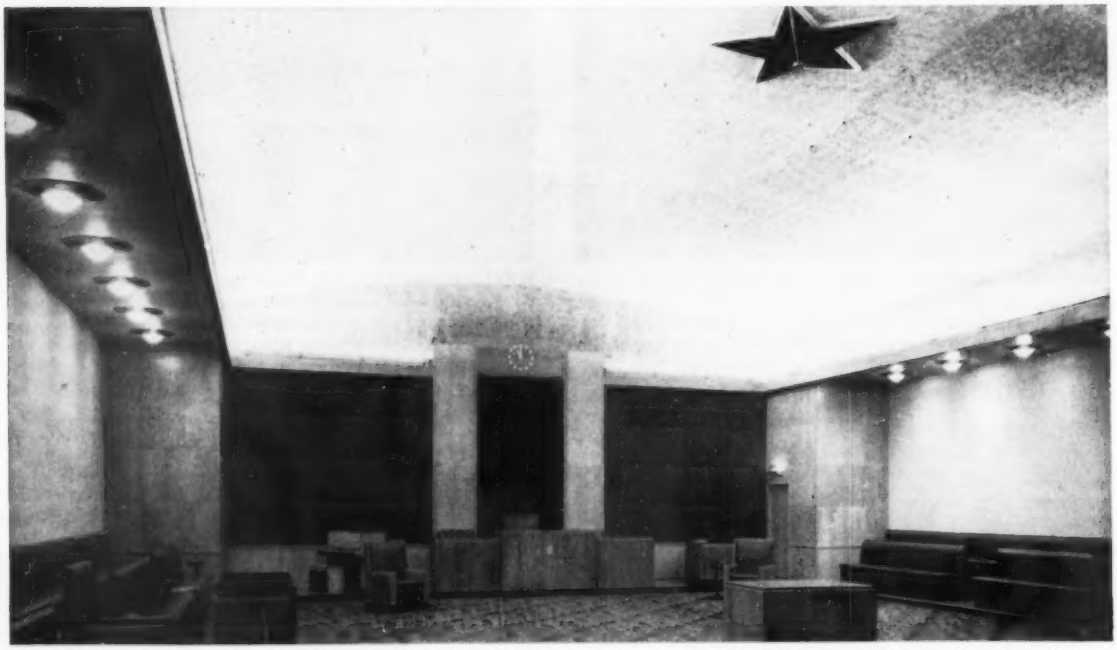
Full-basement storage keeps heavy items out of the shop area and provides obstacle-free passages for movement of repair jobs from one department to another. A basement truck ramp, with trap-door access to the repair floor, shunts loading and unloading operations below shop level. Frequently, a slight design change or addition to shop equipment increases its flexibility and hence overall shop efficiency.

The accompanying photos illustrate some of B-F's new shop ideas. In the new building, management feels it has a layout conducive to improved operating efficiency and employee morale. And time is proving this out.

LIGHTING AIDS RITUAL IN LODGE

Dimmer-controlled lighting system provides zero to 30 footcandles in the Elks Temple lodge room, Coeur d'Alene, Idaho, using 5.3 watts per square foot.

By William A. Lowry, *Lighting Consultant, Washington Water Power Co., Coeur d'Alene, Idaho*



DIRECT—INDIRECT lighting is dimmer-controlled in the Lodge Room, a new addition to the BPOE Temple, Coeur d'Alene, Idaho, and provides flexible and decorative lighting effects for ritualistic, social and other functions.

LIGHTING plays a most important part in lodge ritual, as every lodge member knows. The lighting system should be flexible, and so arranged that a wide variety of intensities and lighting effects are easily obtained and readily available.

BPOE Lodge No. 1254 in Coeur d'Alene, Idaho, has installed a highly flexible direct-indirect lighting system which effectively provides a wide range of lighting effects, and intensities varying from black-out to 30 footcandles average throughout its entire lodge room. This room is a new addition, and is used for ritualistic, social and other lodge functions.

The lodge room is approximately 50 ft. by 68 ft., with a barreled ceiling 20 feet 6 inches high at center. Side walls extend 14 feet up to the base of the ceiling curvature, at which point a cove is installed. The ceiling is limpet-sprayed asbestos, with a 70% reflectance. Side walls are pale green, with 80% reflectance. The floor is covered with red carpeting, having a 42% reflectance, while red leather cushions on furniture and on end wall has a 30% reflection factor. Mahogany furniture and panelling has a 60% reflection factor.

Direct lighting is obtained with 20 No. 2130 Holophane reflector-refractor units, equipped with 75 watt Type A-21 lamps, recessed in Connor Kno-Draft air conditioning outlets.

Indirect lighting is provided by both fluorescent and incandescent light sources, concealed in the cove. The fluorescent tubes extend around the entire perimeter of the room, while the incandescent lamps extend along the coves on the two sides of the room only. Two rows of 15 mm General Electric soft white fluorescent tubes, operating at 30 ma, with a total wattage of 1800 watts, are dimmer controlled through double capacity transformers. A total of 98 incandescent lamps of the 150 watt R-40 reflector flood type project light from the cove to the barreled ceiling to provide an evenly lighted ceiling. These lamps are also dimmer controlled.

In the center of the lodge room is a ceiling-mounted special "star" unit. This unit conceals ten 25-watt standard lamps to light up the blue glass panels of the unit softly, and a No. 2145 Kliegl pinhole spot light using a 100-watt A21 standard lamp.

Two 20-watt fluorescent lamps are used to light the wall mounted clock at one end of the room. Details of the clock are shown in Detail "C".

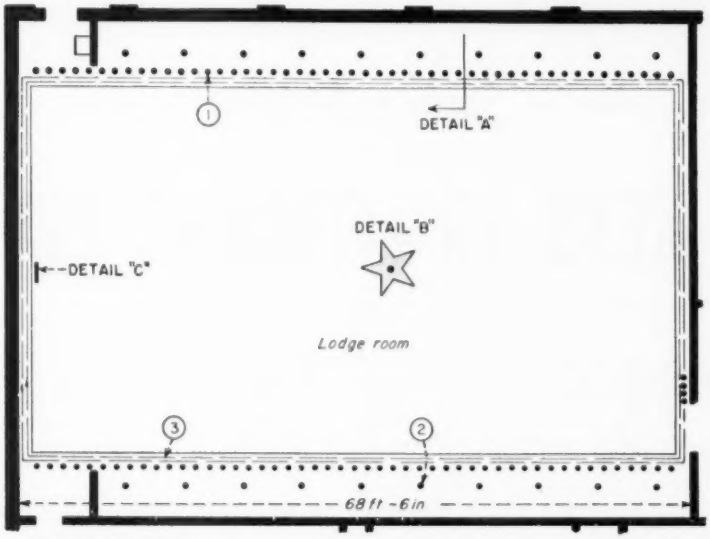
Architect for this $235,000 addition to the Temple was E. J. Peterson of Spokane, Washington. Don D. Rohrer of Spokane was the illuminating engineer, and Power City Electric Co., Spokane, was the electrical contractor.

COVE LIGHTING consists of two rows of 15 mm. cold cathode tubing operated at 30 ma., and row of 150 watt R-40 reflector lamps in each cove. Both the fluorescent and incandescent lamps are controlled by dimmers.

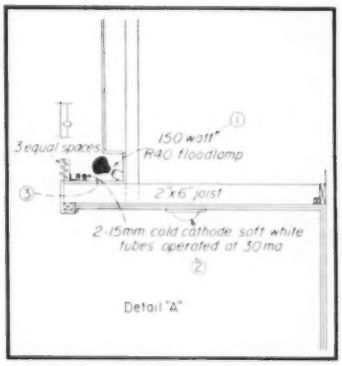
TECHNICAL DATA

Type of Work	Lodge Ritual
Construction	New Addition
Area (Sq. Ft.)	3391
Ceiling Height	20 Ft.-6 In.
Light Sources	Incandescent & Fluorescent
Size Lamps	Misc., 150 w. R40 in Coves
Luminaires	Holophane, Special, & Coves
Watts per Sq. Ft.	5.3
Illumination (Footcandles)	0 to 30*
Cost per Square Foot	
a. Lamps and Luminaires	$0.97
b. Total Electrical Work	$5.25
Electrical Work, Percent of Total Cost	7.5%

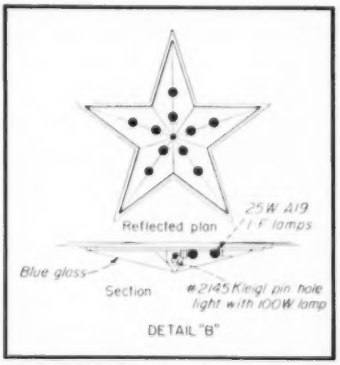
*(All lights on dimmer control)



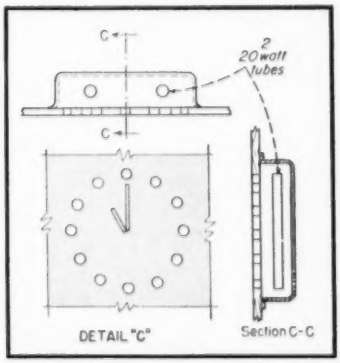
LIGHTING LAYOUT showing 1) 150 watt R-40 reflector lamps, 2) Holophane No. 2130 units, 3) cold cathode tubing in coves, (Detail "A" below). Also shown is illuminated star ("B") and clock ("C").



CROSS-SECTION detail through cove and ceiling under cove, shows location of lamps and lighting equipment.



STAR DETAILS show location of 25 watt lamps above blue glass panels and pinhole spot in center of unit.



WALL CLOCK is made luminous by two 20-watt T-12 fluorescent lamps concealed behind clock face.

WAXED TICKETS provide protective coating over job number so that paint, oil or dirt may be wiped or scraped off easily to reveal pertinent data.

MOTOR DATA CARDS are filed alphabetically by manufacturer and model, facilitating rapid checking of characteristics and related winding information.

Scheduling plus Training

KEYS TO EFFICIENT SHOP OPERATION

"SELLING service rather than merchandise" is a simple expression, yet its attainment requires quality workmanship, smooth workflow, labor-management cooperation, high morale and clear definition of responsibility between departments. These factors in turn demand constant review and improvement of shop methods, inventory procedures, office routines and training programs for new employees.

We have found that these things can be partially insured by an incorporated company structure that permits several of our key men to share in the profits—and risks—of all future endeavors. This provides a definite incentive for the men to coordinate their activities and maintain shop efficiency as high as possible. Second, we are providing for continued quality workmanship by carefully selecting and training young men for our repair department. Mechanical aptitudes and electrical backgrounds are desirable attributes for new employees, but we prefer to train new men "our way" rather than pirate them, already trained, from other motor shops in our district. Through this approach we are assured of uniformity in our repair routines and, we believe, have fostered a healthy "live and let live" attitude among our competitors.

Another way by which we solicit employee cooperation is through an incentive system that covers the entire organization from clerks to shop workers. This system has, as a basis, a set of costs for labor and material, established by experience and checked by supervisors in the shop and office. We believe the costs are a fair representation of normal industry and, by multiplying motors repaired each month by their corresponding cost factors, we come up with a monthly cost index which serves as an efficiency standard. If, through the personal efforts of all employees, this index is bettered and the monthly work quota has been completed with less-than-estimated time or material, the differential profit is split 50-50 between the incorporated firm and employees. In cases where employees are also stockholders, they benefit both ways.

Training begins by acquainting new men with our stock, our method of logging-in damaged motors, our procedure for insuring a perpetual inventory of materials and parts, and our routines for testing, disassembling, repairing and redelivering motors. New men are then placed under the supervision of older, more experienced workers and they learn through observation and duplication; working independently only after their proficiency has been tested and proved.

Job Specialization

Since 98% of our business consists of motors in the fractional and 1-to-5 horsepower classes, we have also found that departmentalizing and specialization has resulted in faster and better repair jobs. With fewer types of work to do, the men soon develop motion-saving methods, thereby performing quality work in minimum time. Departmentalizing also defines responsibility, eliminates "buck passing" and misunderstanding of assignments.

All motors brought into the shop are entered on triplicate job tickets; one copy accompanying the motor into the repair department, the second copy constituting our office record of the

TRANSPORTATION of motors from receiving desk to repair department is by means of suspended carriage traveling beneath inter-area monorail system.

INVENTORY GUIDE BOOK lists manufacturers, identification symbols, bin numbers, starting inventories, withdrawals, replacements and running totals of parts on hand.

Constant progress in shop procedures, a training program for new employees and sound organization contribute to successful motor service.

By John R. Lange
Lange Electric Co., Baltimore, Md.

job, and the third copy going to the customer upon completion of the work and pick-up of the motor. Pick-up and original delivery of motors to the shop is generally a customer responsibility, although we *will* perform this service if the client does not have other means for transportation.

As motors enter the shop they are also tagged with a waxed ticket. We have found that the wax covering protects the tag from dirt, oil and paint as it accompanies the motor through the various repair sequences. Whenever job numbers become blotted out, the wax can be easily scraped away to reveal this information.

Job tickets carry motor brand names and model references and, since the hundreds of data cards which we have assembled are filed alphabetically, all pertinent information can be quickly located for reference.

As motors are received, disassembled and checked for faults, special attention is directed to bearings, brushes, worn shafts and so forth and, if mechanical work is required, it is performed in our machine shop which includes such equipment as drill-, 70-ton hydraulic- and handpresses, two lathes and about 300 different varieties of bearings; each type and size stored in an individual, plainly identified bin. While these parts are being made or located in the stockroom, disassembled motors are placed in tagged pans and dispatched to the assembly department to await the arrival of all necessary components. Transportation of pans is simplified by placing them on a carriage suspended from a monorail between receiving and repair areas.

Inventory Cross Checked

In the stock area, each part is stored in a separate bin tagged in alphabetical order and, in the stockroom office, inventory guide books similarly list manufacturers, numbers, starting inventories, withdrawal amounts and corresponding dates, replacements, running totals of parts on hand, identification symbols and bin numbers. This results in fast identification and accurate residual bookkeeping yet, in the interest of even greater accuracy, a physical count is taken of all items twice each year and these totals are cross-checked with guide books.

Whenever a customer brings in a motor in such poor condition that its reconditioning would result in a charge approaching that for a new motor, the customer is urged to purchase the new motor rather than have the old one repaired. Since we are distributors for several nationally-known brands we can generally supply a satisfactory replacement, show the customer why his investment is economically justified, and guarantee to the customer new-motor performance. It is our policy, however, that when this condition arises, the old motor is neither taken in trade nor repaired for later re-sale to another customer. Inasmuch as our reputation depends upon quality work, we do not believe that a motor, too badly damaged to economically serve one client, should be dressed up and passed off on someone else. It is therefore scrapped. A few borderline motors of popular sizes and types *are* repaired, however, and kept in stock strictly for temporary stand-by service. Therefore, when customers demand continuity of service while their own units are being repaired, we can use these rebuilt stand-bys.

Adjusting Pull-Box Units For Job Conditions

By Ray Ashley Research and Consulting Engineer, Chicago, Illinois

QUESTION: *How much must standard labor units be increased for pull-boxes and fastenings installed in occupied manufacturing spaces?*

ANSWER: *A. Pull Boxes—Labor units should be increased 75 percent for boxes installed in machinery spaces and 25 percent for installation in passages or semi-active areas.*

B. Fastenings—These units should be increased 50 percent.

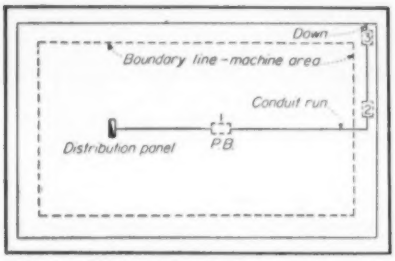


FIG. 1—PULL-BOX LABOR for location "1" over machine area will be much greater than that for Boxes "2" and "3" along wall in passageway.

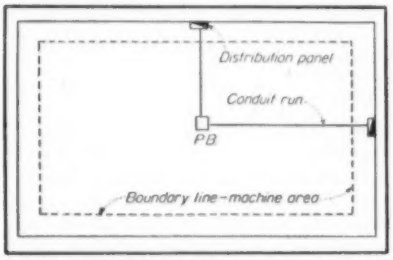


FIG. 2—RIGHT-ANGLE pull-box installation time would approximate that for pull-box "1" in Fig. 1. Same operating area is involved.

PULL-BOX STUDIES

Installation time (man-hours) for a 12" x 24" x 8" pull-box mounted on a 12-foot concrete ceiling

LABOR ITEM	CLEAR SPACES* (Standard Units)	OCCUPIED AREAS (Adjusted Units) Box Location (Fig. 1)		
		1	2	3
1. Receive and Move to Site	0.40	0.50	0.50	0.50
2. Layout and Study Time	0.45	0.54	0.45	0.45
3. Inserts and Fastenings	0.50	0.80	0.75	0.60
4. Erect in Place—includes cutting, threading and making 2 conduit connections	1.20	2.40	1.80	1.44
TOTAL DIRECT LABOR	2.55	4.24	3.50	2.99
Add 20 percent for preparation time, tools, and other incidental labor	0.51	0.85	0.70	0.60
TOTAL MAN-HOURS	3.06	5.09	4.20	3.59
PERCENT INCREASE—Occupied areas over standard units	--	68%	39%	19%

Notes: *Clear Spaces—Standard Units, from Table, page 64, "Electrical Estimating" (McGraw-Hill Book Company)

DISCUSSION: *Pull Boxes*—The location of the pull-box is a determining factor when adjusting labor units for specific job conditions. The distribution system in Fig. 1 shows pull boxes in three different locations—over operating machine areas and in passageways. The accompanying Table gives standard units and comparative units for box installations made in the three indicated locations.

Standard labor units in the Column "Clear Spaces" were taken from tables on pages 64 and 65 of "Electrical Estimating" published by the McGraw-Hill Book Company. Values listed for the three pull-box locations under "Occupied Spaces" were developed from data secured from general studies.

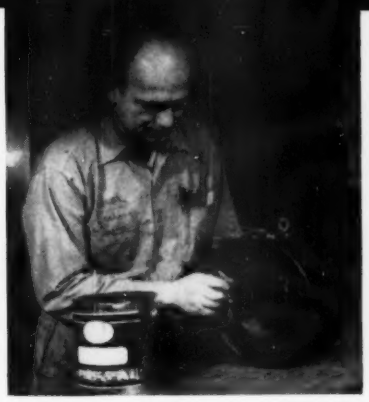
The pull box in location 1 (Fig. 1) is in the active manufacturing area where operating machinery, plant workmen and material handling create a hazard. Although the Table shows a 68 percent increase above standard labor for this location, it is recommended that the estimator use a 75 percent figure unless he is familiar with actual job conditions.

Values for locations 2 and 3 are much less than those for location 1 because these pull-boxes are away from operating machinery. Box No. 3 is in a far corner where mechanics are less subject to hazards than in either of the other two spots. It has been assumed that no stock piles will hamper installation.

Fastenings—An allowance of 50 percent has been made for fastenings. In many cases the labor will be 100 percent or more above standard, but on most work an average of 50 percent can be maintained. Delivery and handling are not factors in labor for fastenings and hangers. The principal labor item is the actual installation. There might be a question about using an increase of 100 percent for conduit and only 50 percent for inserts (hangers, etc.) installed in the same location. Fastenings do not have the same bulk as conduit.

Figure 2 shows a pull-box at a 90° turn in the conduit run. Installation time for this box would be practically the same as that for pull-box No. 1 in Fig. 1. Cable pulling is the main problem created by boxes installed at right-angle turns. This item will be discussed in a later article along with other factors involved in pulling cable in occupied manufacturing areas.

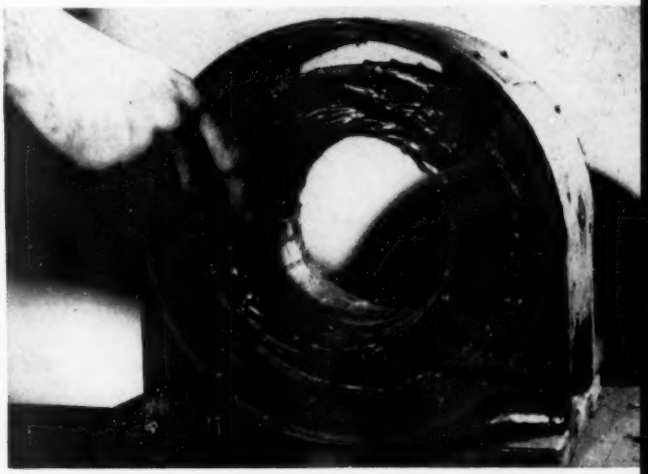
STEP 1. Stator for 3 hp motor has just been removed from oven where it was pre-heated at 285 degrees F. Preheating allows thicker coat of corrosion-proofing.



STEP 2. Vinyl plastic corrosion-proof coating is applied to the pre-heated stator coil by an ordinary paint brush. Coating can be built-up to desired thickness.

STEP 3. Coated motor stator is placed in oven and baked for 30-40 minutes at 285 degrees F to assure proper curing of the plastic coating.

STEP 4. After baking for 30-40 minutes, the motor is taken from the oven and inspected. If a heavier coat is desired, it can be applied to the already hot coating, setting-up quickly and requiring little more curing.



STEP 5. With only one application of the plastic compound, the stator winding is completely sealed and ready for use. The coating is tough, flexible and corrosion-proof, with high thermal conductivity.

Insulating Windings with VINYL PLASTIC

Vinyl plastic compounds, applied with a minimum amount of equipment, now offer effective protection against corrosion by chemicals and moisture in motor windings

A NEW series of vinyl plastic formulations now afford fast and effective application for corrosion-proofing motor windings and other electrical components. Made from Goodrich Chemical Company's Geon paste resin, these plastic compounds are manufactured by the John C. Dolph Company to provide maximum protection against alkalies, acids, oil, dirt, dust, carbon, abrasive particles and moisture.

As shown in the accompanying illustrations, insulating stator coils on open wound motors is a simple procedure. In this case, one of the typical plastic compounds is applied by an ordinary paint brush after the unit is preheated to 285 degrees F. The compound sets-up immediately upon contact with the heated copper coils and iron frame, and continual application of more plastic can be made to obtain the desired thickness of coating. After the proper build-up of compound is obtained, the unit is cured in a baking oven for 50 minutes at 285 degrees F. If too rapid cooling of the unit should prevent the desired build-up of compound during the first application, the unit may be reheated for 10 minutes and then coated with additional plastic. The two layers applied in this manner will form into one solid mass of coating.

Depending upon the type of equipment to be protected, the compounds may be applied by brush, dipping or spraying. In addition to their use on motor windings, the compounds can be used to coat bus bars, transformers and small electrical units.

TRACTOR DRIVER activates winch, pulling movable sheave on wheel carriage down, forcing the wheels down and raising the trailer body. This operation also elevates . . .

PLOW HEAD above the ground, permitting wire to be led from reel, through tail-boom pulley, down to plow-head sheave and out. Then, as tractor moves forward. . . .

WHEELS ARE RETRACTED and plow settles down with plow head underground at the desired depth. Without actually removing earth or creating an open trench. . . .

WIRE IS LAID UNDERGROUND in one operation. Wire reels are delivered as needed in panel truck

WIRE PLOW

Speeds Underground Work

Trenching, underground cable laying and backfilling are combined into a single operation through the use of a tractor-pulled machine by the California Electric Works, San Diego.

LAYING cable underground, for parkway lighting, boundary marking or grounding purposes, calls for three operations: trenching, cabling and backfilling.

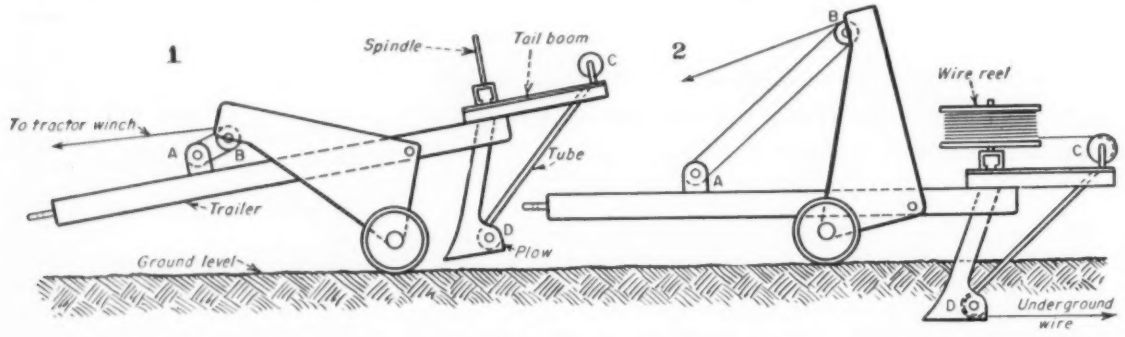
When all earth handling was by pick-and-shovel crews this was a manually tiring, time consuming chore. Then, when rotary bucket wheels and bulldozers were adopted, conservation of time and effort was realized to an important degree. Yet the ultimate in simplification is now found in a machine used by the California Electric Works of San Diego, because this machine accomplished all three jobs simultaneously.

The device is of rugged construction, consisting essentially of a heavy, tractor-pulled trailer, a plow, a spindle to hold a wire reel, a tube running diagonally downward from the end of a tail boom to a point just behind the plow head, and an assortment of sheaves and pulleys.

Trailer wheels are broad-rimmed to minimize sinking into soft ground. They are mounted on a triangular carriage, at the ends of the short legs. A sheave is mounted between the long legs, while the carriage is pivoted at the right-angle point.

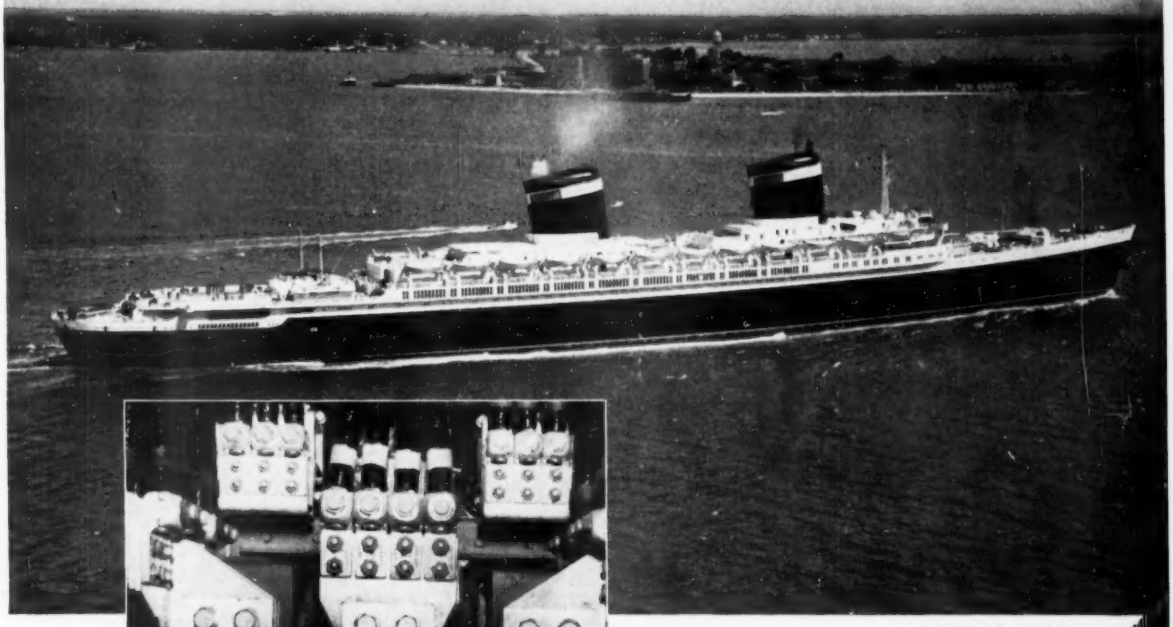
In effect, two of the three essential operations are eliminated, because earth is never actually removed (as would be the case with trenching) and, therefore, there is no necessity for backfilling.

As California Electric's General Manager V. R. Knight puts it, "Our wire plow has cultivated a fertile field. Each job seems to plant the seed for additional work, and we are reaping a harvest of savings which we are glad to share with our customers."

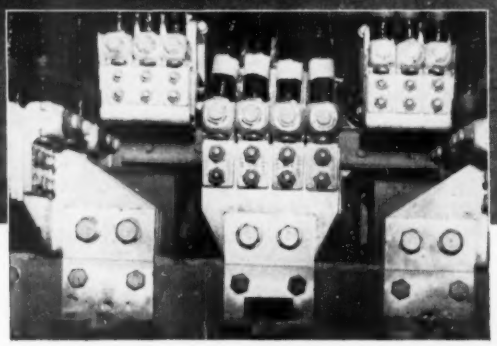


WIRE PLOW is mounted on tractor-drawn trailer. Wheels are raised and plow head is lowered when tension on winch cable is slackened and sheaves A and B are permitted to separate. Wire reel is held by spindle while wire passes around pulley C, down through tube to sheave D, and along desired underground path.

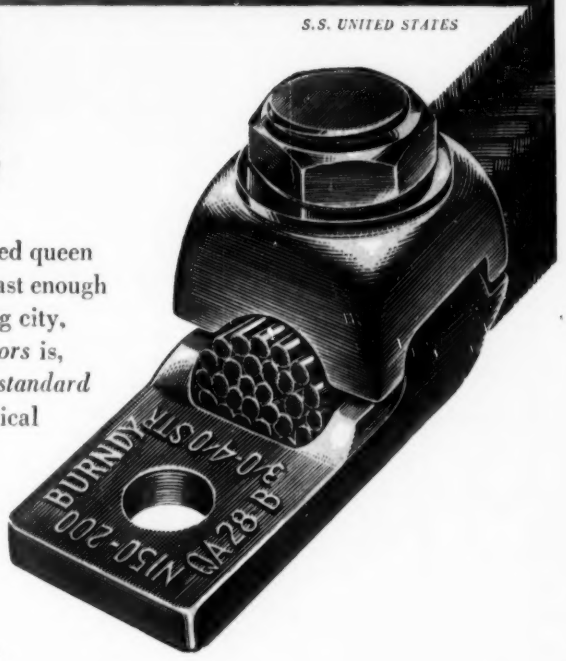
proud to be aboard!



S.S. UNITED STATES



QIKLUG



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SELECTING POWER FEEDERS

How to relate economy to design adequacy in selecting power feeders for circuits rated 600 volts and lower—based on

- **CABLE PERFORMANCE CAPABILITIES**
- **RELATIVE PURCHASE PRICES OF CABLES**
- **INSTALLED COSTS PER UNIT LENGTH.**

By Charles T. Paugh, P. E.
Glen Burnie, Md.

SELECTING the most economical power feeders for circuits rated 600 volts and lower is basically a matter of relating cable costs to cable performance. From a study of these factors, reliable data can be developed to assure an economy of cable selection consistent with wiring design adequacy. These data will point up the relative advantages of the various sizes of cable, installed open and in conduit, single and three conductor cables, with single and multiple cables per phase.

That economy has been recognized as an important factor in the selection of power feeders is clearly evident in current practice. For example, some recent catalogs of electric cable have not listed beyond the 1000 MCM size. This is a direct result of the small demand for larger sizes of cable due to their unfavorable rating in the current capacity tables. A tendency in wiring design today is to shy away from large cable sizes in favor of mutiple parallel conductors. In recognition of this tendency, distribution panels are now commonly offered with 500 MCM maximum-size cable connectors and multiple connectors if required.

Unfortunately, however, power feeders are too often selected on the basis of their ratings in the code table of current capacities. Such selection is inadequate because the code table is based solely on the allowable temperature rise of the insulation used. Voltage drop and the corresponding power loss in the feeder through all the years of its service are not considered.

Thorough study of the problem of voltage drop shows that, for average conditions, feeders with a 2% voltage drop—compared to the next smaller size—will usually liquidate the added cost in about five years or less. In addition, the larger cable size in such a case offers a desirable reserve capacity for future overloads. Another advantage of this practice is that regular use can be made of moisture-resisting thermoplastic insulation with a 60 C rating, which costs less than others with a higher rating.

POWER FEEDER SPECIFICATION DATA

P	Cable Size	Cables Per Phase	Conduit Size	Cost in Dollars Per 100 Feet	Ampere Rating NE Code	Dollars Per 100 Feet Per Unit P	Economic Choice *
2.0	4	1	1¼	$136.00	70	$68.00	
3.0	2	1	1¼	151.00	95	50.30	
3.7	1	1	1½	189.00	110	51.10	
4.6	0	1	2	237.00	125	51.50	
5.5	2/0	1	2	260.00	145	47.20	
6.6	3/0	1	2	286.00	165	43.40	
7.4	1	2	2½	342.00	176	46.30	B
7.7	4/0	1	2½	356.00	195	46.30	A
8.2	250	1	2½	421.00	255	51.40	B
9.2	0	2	2½	378.00	200	41.10	A
9.5	350	1	3	532.00	310	56.00	C
11.0	2/0	2	3	468.00	232	42.50	A
11.0	500	1	3	622.00	380	56.60	C
11.2	1	3	3	472.00	231	42.20	B
13.2	3/0	2	3	521.00	264	39.50	A
13.8	0	3	3	526.00	262	38.10	A
15.4	4/0	2	3	586.00	312	38.00	A
16.4	250	2	3½	755.00	408	46.00	B
16.5	2/0	3	3½	634.00	304	38.40	A
19.8	3/0	3	3½	713.00	346	36.00	A
23.1	4/0	3	4	848.00	410	36.70	A
24.5	250	3	4½	1085.00	535	44.30	A

Wiring in steel conduit for up to 600-volt three-phase 30 C ambient NE Code ratings.
Size 250 MCM and above—Heat and moisture resistant rubber type cable insulation with 75 C rating.
Below 250 MCM—Thermoplastic cable insulation with 60 C rating.

*A—Preferred
B—Second Choice
C—Uneconomical

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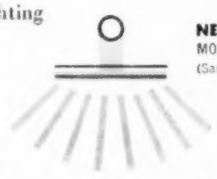

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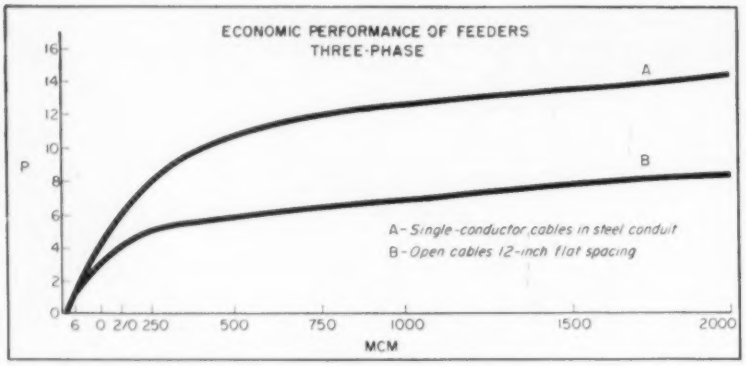


FIG. 1. Cable sizes 1000 MCM and up exhibit only a small increase in performance capability, making their use economically inadvisable.

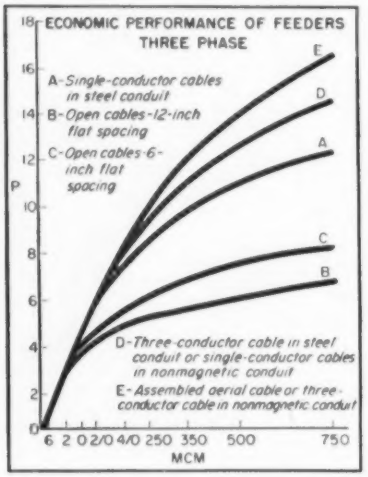

ECONOMIC PERFORMANCE OF FEEDERS
THREE PHASE
P
A-Single-conductor cables in steel conduit
B-Open cables-12-inch flat spacing
C-Open cables-6-inch flat spacing
D-Three-conductor cable in steel conduit or single-conductor cables in nonmagnetic conduit
E-Assembled aerial cable or three-conductor cable in nonmagnetic conduit
6 2 0 2/0 4/0 250 350 500 750
MCM

FIG. 2. Open conductors at any spacing are uneconomical; self-supporting aerial cable, however, rates high in economy.

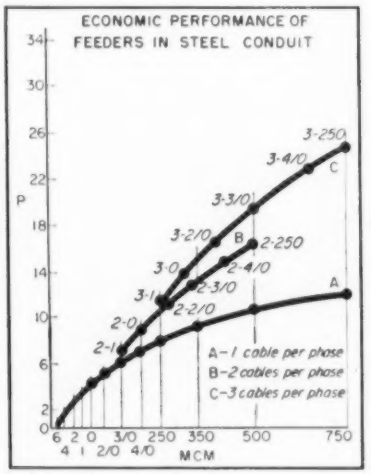


FIG. 3. Multiple conductors per phase offer advantages over single conductors in steel conduit.

From the foregoing then, selection of the most economical power feeders must take into consideration cable performance capability for transmitting power, relative purchase prices of the various cables and installed costs per unit length, including conduit if used.

Performance

A suitable unit for comparing the performance of cables is P, which is defined as (1) $P=LxI/dVx1000$ where, L=feeder length in feet
I = load current in amperes
dV=feeder voltage drop
(1000 is included for brevity)

Based on the average value of load power factor, 0.8 to 0.95, it can be assumed that voltage drop in a feeder is equal to the impedance drop, so that dV in Equation (1) becomes $LIZ\sqrt{3}/1000$, Equation (1) then simplifies to

(2) $P=1/(Z\sqrt{3})$

where, Z=ohms to neutral impedance per 1000 feet of feeder.

Equation (2) was used to calculate the values of P for different cable sizes used in the following study which, though made on 440-volt 3-phase 60-cycle feeders, is applicable to feeders at any common secondary voltage. Figs. 1 through 5 illustrate the data developed. Cable insulated with polyvinyl chloride and rated at 60 C was used for sizes 4/0 and smaller. Heat-resistant neoprene-insulated cable rated at 75 C was used for the larger sizes. Slight variations in the calculated values of P, due to the change-over in type of insulation, were resolved to make continuous curves in the illustrations.

Fig. 1 illustrates the values of P for cable sizes up to 2000 MCM, and for the two common conditions of three single-conductor cables in a steel conduit, or mounted on insulators in open air. It points out the inadvisability of using cable 1000 MCM or larger, since there is, relative to cost, only a small increase in P. Thus, all other graphs are limited to 750 MCM. In addition, curve B points out the substantial reduction in performance with separate phase conductors, spaced 12 inches, and discourages the use of this type of construction. Note that the P value of a 2/0 conductor (5.5) is 37% that of a 2000 MCM conductor (14.8), but—and this is important—uses only one-fifteenth the copper.

Fig. 2 is similar to Fig. 1 and is plotted to double scale for better accuracy in the useful range. The curve for single conductors in a steel conduit is the same as shown in Fig. 1; the others were selected for appropriate comparison with the latter. As the graph shows, open conductors at any spacing are uneconomical. The performance of self-supporting aerial cable is particularly noteworthy, indicating that it should be given full consideration when ever practicable. Where conduit is required, any of the nonmagnetic materials has a definite advantage over steel provided the conditions permit its use. Direct burial cable with nonmagnetic shielding has the same performance values. This graph is intended for regular use in feeder selection and specification pointing up relative performances.

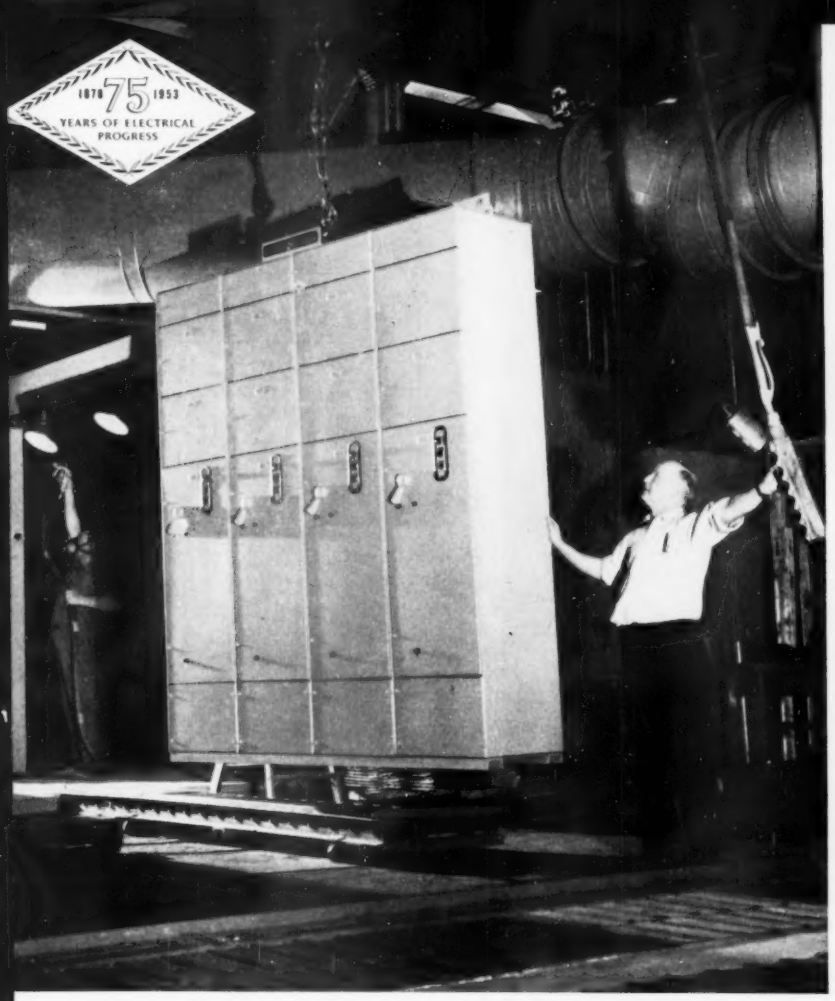
The curve for single conductors in steel conduits is again plotted in Fig. 3, curve A. Curves of two and three conductors are added to show the advantages of multiple conductors in this range of sizes. A good example of the use of Fig. 3 is the following: One can tell at a glance that three No. 0 size cables in parallel have a higher equivalent P than a single 750 MCM cable yet they use only 42% of the copper.

The curves of Fig. 4, are drawn for self-supporting aerial cable or "preassembled aerial cable" as described in some catalogs. Its performance exceeds the other types and is therefore recommended for more extensive use.

P vs Cost

What cable specification will produce the required performance for the lowest investment? Fig. 5 attempts to answer this question—it includes the purchase price of the various sizes of single-conductor cable and uses performance values as installed in steel conduit. It is at once apparent from the graph that the lowest unit cost per unit of performance is obtained with sizes 4 to 4/0 cable—all other sizes involve higher cost.

The question of insulation, a substantial cost factor, now arises. Synthetic rubber has made possible



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The world's largest exclusive manufacturer of time controls

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Selecting Power Feeders

. . . *Starts on page 120*

excellent heat-and-moisture-resisting compounds—Types RH and RW. However, along with their high quality is a comparatively high cost. Thermoplastic insulation for use in wet locations, Type TW, presents a favorable price list. The $\frac{4}{64}$ inch insulation on thermoplastic wire is considered to be the minimum insulation thickness advisable for industrial power wiring. Its characteristics fully qualify it for use in all normal power-wiring applications where operating temperatures do not exceed its specified rating.

The Table of Power Feeder Data is based on the installed cost of steel conduit, carrying thermoplastic insulated cable up to 250 MCM. For sizes 250 MCM and larger heat-and-moisture-resistant rubber insulated cable is used. The costs are based on regular estimating figures in use during 1950 and include direct labor but not overhead. Similar tabulations can be constructed based on other conditions, but differences will be mainly a relative shift of costs. The Table is in general agreement with Fig. 5. It exhibits substantial economy in the use of multiple cables and indicates that the need for cable larger than 250 MCM should be viewed with suspicion. Notice the advantage in using multiple conductors when the P factor is seven or higher. The tabulated data is graphed in Fig. 6.

But what about ampere capacity ratings of the various combinations? Isn't it true that these values must be checked to assure their being equal to

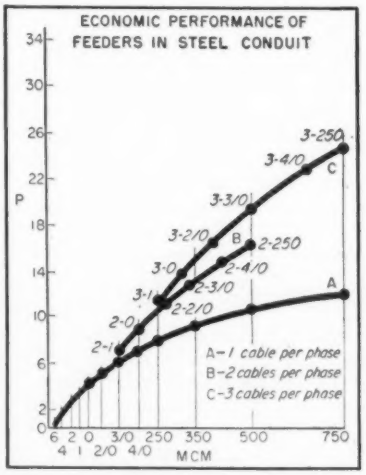

FIG. 4. The advantages of self-supporting aerial cable recommend its wider use in feeders.

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Selecting Power Feeders

. . . Starts on page 120

load requirements? The answer is yes. For feeders longer than 200 feet the current rating will usually be found greater than required, but for shorter feeders a larger cable size may be in order. However, the larger cable size has a higher P factor, with a lower power loss, and hence should liquidate the added cost in a reasonable time. Multiple conduits are sometimes used with multiple conductors to avoid the 80% or 70% derating factor for six or nine wires in a single conduit. This is an unwise practice since there's no increase in the P factor.

The use of the Table is illustrated by a few examples:

(1) Amp 300
Volts 440
Length 270 feet
Ambient 30 C
2% voltage drop allowed
$P = LxI/dVx1000 = 270x300/8.8 x 1000 = 9.2$

[Continued on page 129]

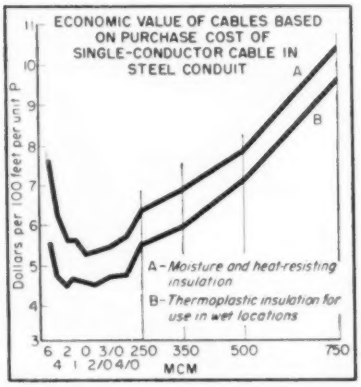
ECONOMIC VALUE OF CABLES BASED ON PURCHASE COST OF SINGLE-CONDUCTOR CABLE IN STEEL CONDUIT
Dollars per 100 feet per unit P
A
B
A-Moisture and heat-resisting insulation
B-Thermoplastic insulation for use in wet locations
6 4 2 1 0 2/0 3/0 4/0 250 350 500 750
MCM

FIG. 5. Cable sizes 4 to 4/0 offer the lowest unit costs per unit of P.

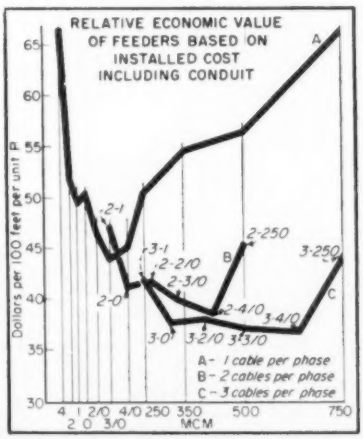

FIG. 6. In the heavier sizes, multiple cables per phase offer most value per

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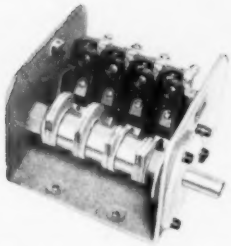

Bulletin 801 Rotating Adjustable Cam Limit Switch. Heavy duty

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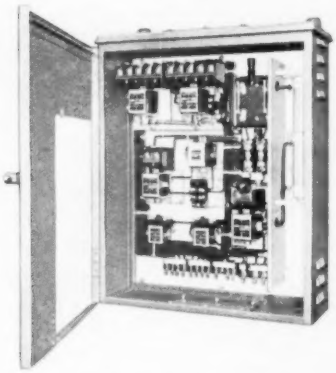
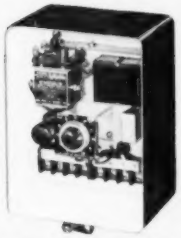


Bulletin 290R D-C Reduced Voltage, Reversing Starter for marine service



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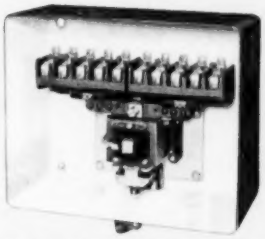

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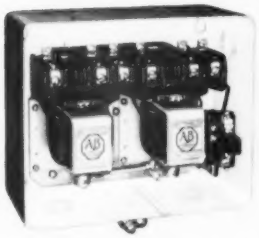
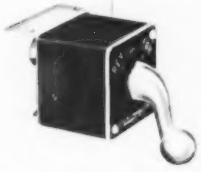


Bulletin 205 Size 1 Reversing Switch for direct current motors



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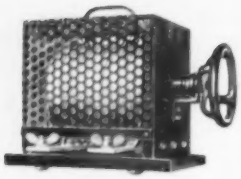
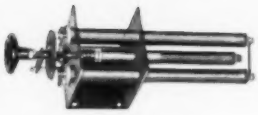


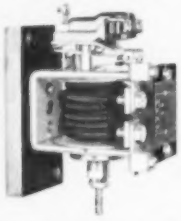
Bulletin 470 Graphite Disc Rheostat for laboratories

Bulletin 500 Knee and Foot Controllers for sewing machines

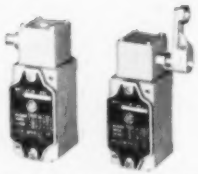
Bulletin 802 Foot Switch for heavy duty, rough service



Bulletin 410 Graphite Disc Rheostat for stepless control



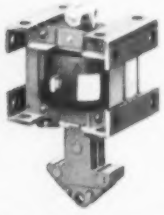
Bulletin 809 Instantaneous Current Jam-type Relay



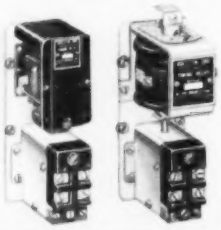
Bulletin 802 Limit Switches with various operating levers

Bulletin 600 Switch with overload breaker and pilot light

Bulletin 848 Dashpot Timing Relay. Maximum interval 30 sec.

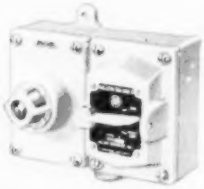


Bulletin 860 A-C Solenoid supplied in variety of ratings



Bulletin 849 Pneumatic Timers for machine tool service

Bulletin 202 D-C Contactors for applications up to 150 amperes

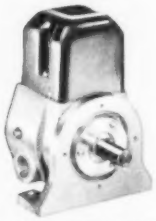


Bulletin 600 Watertight Starting Switch with pilot light

Bulletin 840 Float Switch operated by float and chain

Bulletin 800T Oiltight Push Buttons for machine tools

Bulletin 801 Rocker Arm Limit Switch for reversing service



Bulletin 808 Zero Speed Plugging Switch with magnetic lockout

Popular Accessories

in THE ALLEN-BRADLEY LINE

Look for the A-B trademark. It is a guarantee of Quality

Above are shown a few Allen-Bradley control accessories. The variety of these units reveals the wide scope of the complete Allen-Bradley line. To machinery designers and plant engineers, the Allen-Bradley Catalog is a treasure house of standard control accessories which can be used in innumerable combinations to solve virtually any control problem. May we send you a copy of this Handy Catalog?

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.

ALLEN-BRADLEY

MOTOR CONTROL

QUALITY

2-53-MR

Selecting Power Feeders

. . . *Starts on page 120*

From the Table, on the basis of the voltage drop alone, two 1/0 thermoplastic cables per phase in a 2½-inch conduit would suffice. This combination, however, would carry only 200 amp.

To carry 300 amp the Table gives three possibilities—

(a) One 350 MCM per phase at cost per unit P of $56.

(b) Two 4/0 Awg per phase at cost per unit P of $38.

(c) Three 2/0 Awg per phase at cost per unit P of $38.40.

On the basis of cost per unit P, the most economical selection is (b).

(2) Amp 150
Volts 440
Length 645 feet
Ambient 30 C
Voltage drop 2%
P=L x I/dV x 1000=645x 150/ 8.8x1000=11

From the Table, three choices are available for P=11

(a) One 500 MCM per phase at cost per unit P of $56.60

(b) Two 2/0 Awg per phase at cost per unit P of $42.50

(c) Three No. 1 Awg per phase at cost per unit P of $42.20

All three alternatives have current ratings in excess of the 150 amp required. Alternate (b) is chosen over (c) because, although slightly higher in cost per unit P, the termination problem is simpler. Cost factors not included in the table, such as cable termination in this case, must always be considered.

Economy Practice

1. Limit normal specifications to 4/0 maximum cable size and double check all cases that appear to require larger than 250 MCM.

2. Discourage the use of all regular-type cable larger than 500 MCM (this could be reduced to 250 MCM).

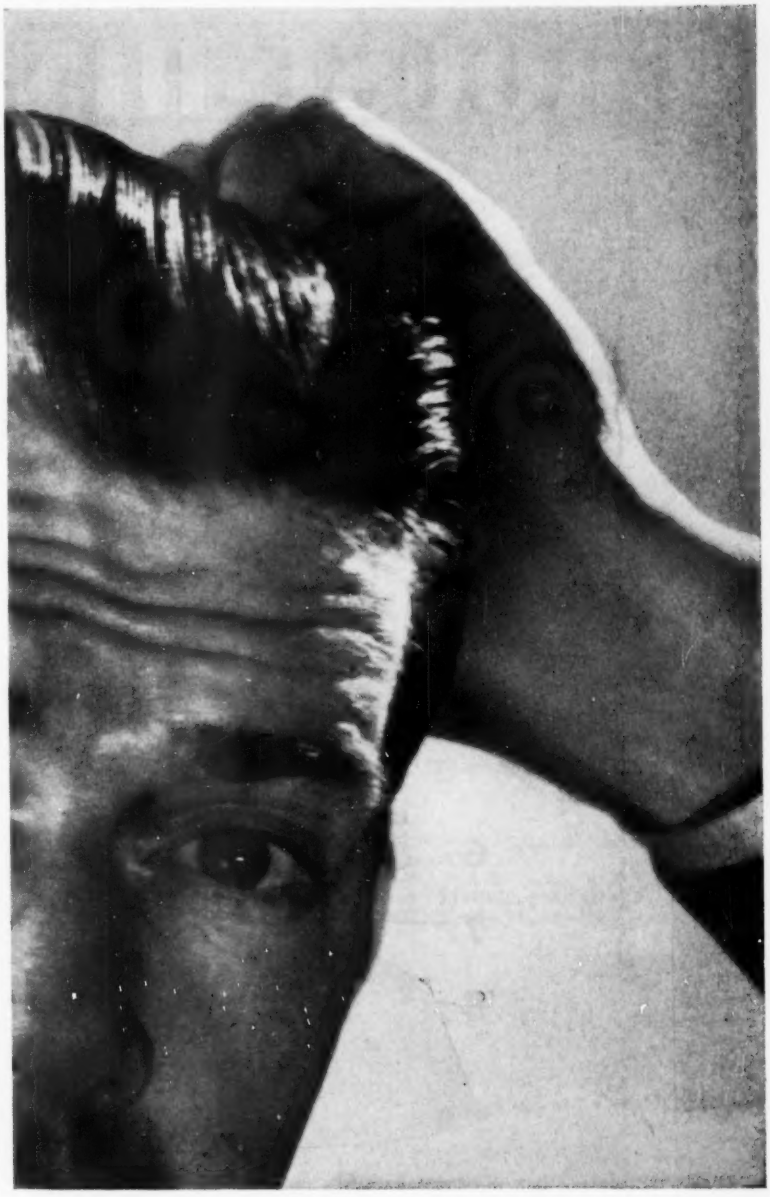
3. For short feeders requiring very high current capacity, consider other constructions such as bus duct, annular, or segmental cable.

4. Wherever practicable, eliminate the use of all separated and spaced single conductors.

5. Where conduit is required, give more consideration to the nonmagnetic materials.

6. Make wider use of preassembled aerial cable.

7. For aerial cable consider use of moisture-resisting thermoplastic insulation.



Don't scratch for the solution—

"AMPROBE" IT!

Is that motor overloaded? Does the system need rewiring? Snap the Amprobe around one conductor (insulated or uninsulated) and you have your answer in seconds. It's the only pocket-size snap-around volt-ammeter, for measuring current instantly without shut-downs or ammeter connections. Write for Catalog. Dpt. ECM33. Pyramid Instrument Corp., Lynbrook, N. Y. (Export Div.: 458 Broadway, N. Y. 13).

Amprobe "600" 0-15/30/60/150/300/600 amps A-C. 0-150/300/600 volts A-C. Complete with cowhide case and voltage test leads, $59.50. Amprobe "1200" (to 1200 amps A-C) $67.50 complete. Amprobe "300" (to 300 amps A-C) $49.50 complete.

CROUSE-HINDS EV Series

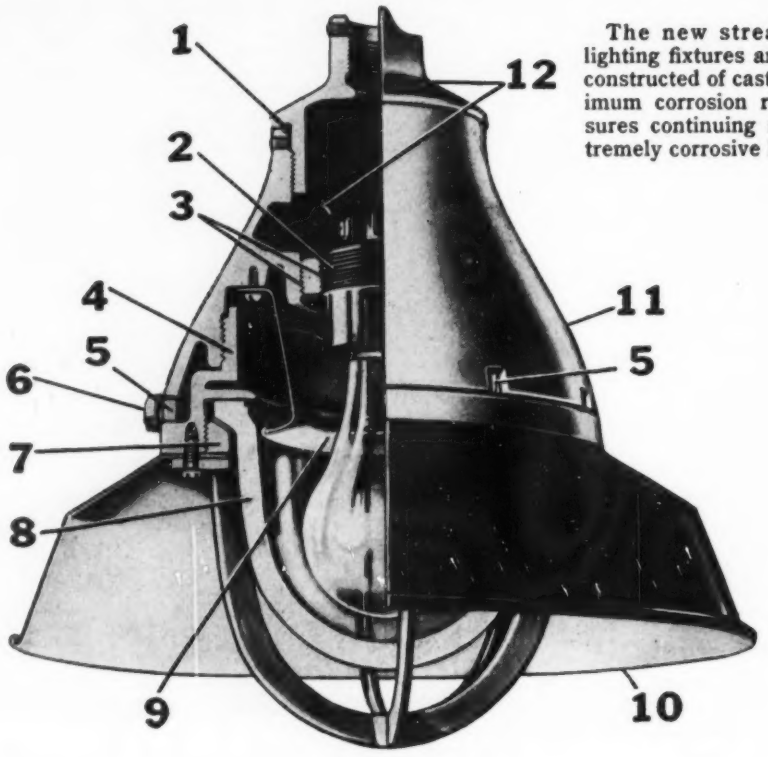
have been redesigned to give you:

EASIEST installation

EASIEST maintenance

HIGHEST efficiency

This adds up to big savings on every installation!

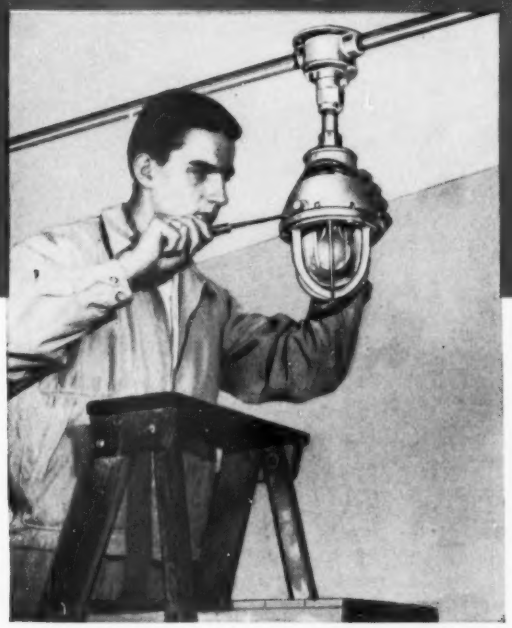


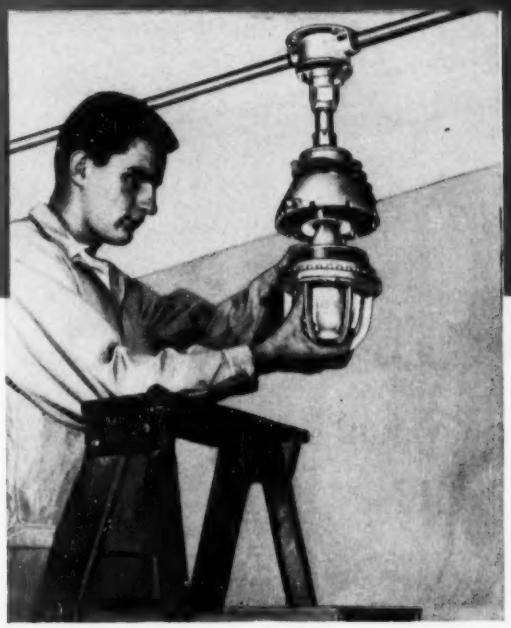
The new streamlined EV lighting fixtures are completely constructed of cast metal. Maximum corrosion resistance insures continuing safety in extremely corrosive locations.

1. Rubber O-ring gasket . . . seals joint against dirt or liquids.
2. New improved shock-absorbing receptacle has "universal" action . . . absorbs shock from *any* direction.
3. Threaded joints are flame tight . . . no sealing compound or external seals are required.
4. Lightweight one-piece assembly of globe, holder, guard and reflector is threaded high up inside of hood . . . no liquid or dirt can enter.
5. Notches in hood and globe holder . . . easy to loosen with a screwdriver.
6. Large knurled thumb screw . . . sets between notches for positive locking.
7. Globe retaining ring and cushioning gasket.
8. Heat and impact resisting globe. The accurately ground flange, essential for safety, is protected in a factory assembled joint . . . never exposed to damage.
9. Auxiliary reflector . . . etched Alzak aluminum . . . eliminates "trapped" light.
10. Porcelain enameled steel reflector.
11. Cast aluminum hood.
12. Cast aluminum body . . . has two openings for easier wiring from either side.

CONDULETS · AIRPORT LIGHTING

Explosion-Proof LIGHTING FIXTURES





Easiest Relamping—3 Simple Steps

1. Single unit globe-holder assembly threaded into fixture hood is quickly removable for relamping. Slots are provided for prying with a screw-driver when necessary in corrosive atmospheres or other severe conditions. A large knurled thumb screw is easily loosened to unlock the globe and holder.

2. Globe and holder complete with guard (and reflector if used) is removed as an assembly. Only one lightweight piece to handle—globe retained in holder with flame-tight joint fully protected. Explosion-proof integrity assured. The 200/300-watt globe-holder assembly weighs but 8 lbs.

The new design of EV Explosion-Proof Lighting Fixtures is based on exhaustive studies and tests in Crouse-Hinds laboratories. The goal was to produce a fixture that would be easier to install and easier to relamp than any other explosion-proof fixture. Crouse-Hinds designers not only achieved this result but also created a fixture having the highest possible lighting efficiency.

You get 3-way savings when you install Crouse-Hinds EV Lighting Fixtures: quicker installation; quicker relamping; more light. This makes them the best buy for lighting in any location that is hazardous because of the possibility of the presence of flammable atmospheres. Use them on every job and have the best!

CROUSE-HINDS COMPANY
Syracuse 1, N. Y.

OFFICES: Birmingham — Boston — Buffalo — Chicago — Cincinnati — Cleveland — Dallas — Denver
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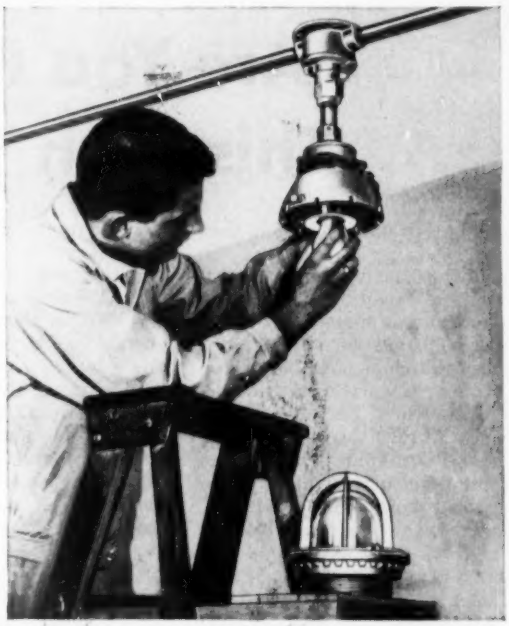


3. In relamping only a lamp is carried up and down the ladder and one assembly handled. It is not necessary to stock any spare parts or assemblies for complete convenience.

TRAFFIC SIGNALS · FLOODLIGHTS

Are You Putting Up This Sign Too Often?

Putting this sign up *just once* is too often.

Most of the time it means a costly shut-down, idle workmen, delayed production, very often caused by the failure of such a low-cost, but extremely vital item as portable cords. U. S. Rubber scientists have engineered U. S. Royal Portable Cords and Cables to give the longest possible life and durability. The flexible conductors are insulated with a high-grade rubber compound, and the conductor assembly is protected by 60% Neoprene jacket vulcanized in lead — thereby assuring maximum density and ruggedness. Rubber fillers are used in all portable cables, and also in the larger sizes of the portable cords. In all cases, the Neoprene jacket is reinforced internally with a strong fibrous braid.

U. S. Royal Portable Cords and Cables have extra efficiency and strength that make them ideal for use on portable electric machinery, tools, lamps, electric sanders and polishers, railroad equipment, and wherever a tough flexible cord is required.

Remember that United States Rubber Company is the only manufacturer of electrical wire and cable to grow its own natural rubber and make its own synthetic rubber and plastics. That's why "U. S." gives you a quality controlled product. Write to address below for your free copy of our general catalog on electrical wires and cables.

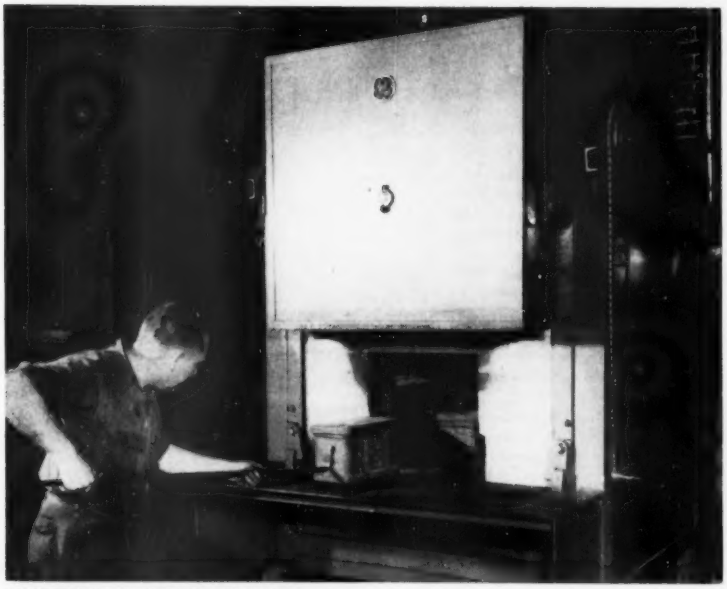
UNITED STATES RUBBER COMPANY

U.S.RUBBER
SERVING THROUGH SCIENCE

Electrical Wire and Cable Department

Rockefeller Center • New York 20, New York

Practical Methods



BOX TYPE ELECTRIC FURNACE results in constant heat, uniform hardness of product, fewer rejects. Pieces maintain unusually high standard of uniformity.

Electric Furnace Improves Quality of Dental Forgings

ELECTRIC HEAT

Faster production, fewer rejects and more uniform hardness of dental tools is obtained through the use of an electric box-type furnace by the S. S. White Dental Manufacturing Co. of Philadelphia, the world's largest manufacturer of dental instruments.

"Electric heat is more satisfactory than previous methods because it is more constant, has less than 15% variation and produces forgings that are more uniform in hardness", say the firm's engineers, adding that "these units facilitate machining and bending."

The model shown, a G. E. 220-volt unit, has a temperature rating of 1850 degrees F and a capacity of 200 forgings a day of both carbon and stainless steel. The forgings are heated for eight hours and then allowed to cool overnight before being removed.

Safety Thermostat Protects Heat-Exchanger

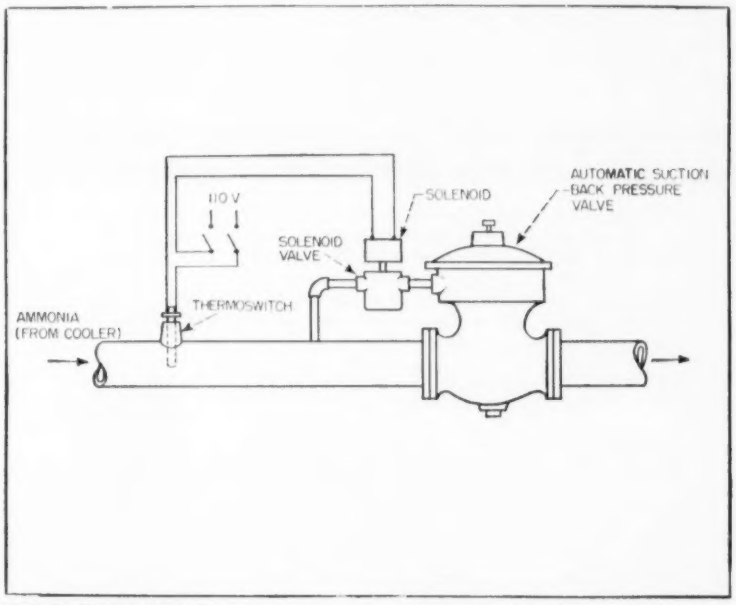
CONTROL

A safety thermostat in an ammonia-cooled heat exchanger prevents freezing and possible spoilage of the product if the regular temperature controller permits the temperature to fall too low. The low temperature safety cut-off action is provided by an inverse Thermoswitch, a precision thermostat manufactured by Fenwal, Inc., Ashland, Mass.

As shown in the diagram, the thermostat is placed in the ammonia line from the cooler unit, where it can sense the temperature of the coolant before it enters the heat exchanger. The ammonia coolant is circulated through the system by suction. The Thermoswitch is wired in series with a solenoid which controls the action of an ammonia back-pressure valve, with the circuit fed from a 110-volt line. At normal operating temperatures, the thermostat contacts are open, maintaining the back-pressure value in the closed position. But when the temperature drops to the danger point, the thermostat contacts close and trip the solenoid, forcing the valve to open and thereby destroy the suction in the line. The coolant then ceases to circulate until the temperature returns to the normal level, at which time the thermostat will again de-energize the solenoid, closing the valve and restoring suction to the line.

With a safety control circuit of this type, the thermostat is usually wired to an alarm circuit which warns the operator of any abnormal condition.

This type of thermostat application can be used in a wide range of cases where it is desired to actuate an electrical control device in response to a temperature change. Although in the case described here the thermostat contacts are normally open. Thermostats are available for circuit-opening operation.



SAFETY THERMOSTAT in heat exchanger system actuates solenoid to provide circulation cut-off when temperature of ammonia coolant falls too low.

TEN GOOD REASONS

TO SPECIFY JEFFERSON MERCURY LAMP TRANSFORMERS

1. EASY MOUNTING!

Keyhole slots for easy positioning and two holes for locking bolts in both top and bottom brackets. Brackets are reversible or removable for messenger wire suspension, etc.

2. PLENTY OF KNOCKOUTS!

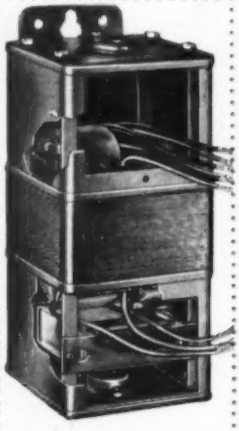
One-half and ¾" knockouts in sides of wiring compartments at each end. Two ½" knockouts in each end plate.

3. INCANDESCENT & MERCURY LAMP LEADS, BOTH ENDS!

For fast, convenient wiring of combination mercury vapor and incandescent lamp fixtures. Mercury lamps can also be wired from either end of transformer.

4. THREE PRIMARY TAPS!

Color-coded tagged leads for positive identification and quick wiring. 3 primary taps (not 2) for close matching with line voltage.



5. DOUBLE VARNISHED CORE & COIL!

Oven baked polymerizing varnish impregnation assures permanent insulation and protection against moisture.

6. INTERCHANGEABLE FITTINGS!

Pryouts on both ends expose standard ½" conduit fittings for suspension type mounting of transformer and/or lamp. ¾" fittings quickly interchangeable.

7. AMPLE WIRING COMPARTMENTS!

Condenser located to provide full wiring space when any knockout is used. Solid U-Bracket mounting prevents vibration damage to condenser and leads.

8. NO OBSTRUCTIONS!

Plenty of wiring room between condenser and conduit fittings. Run wiring through lamp suspension conduit . . . save time, trouble, and outside wiring.

9. PRESS FIT RIVETED CORE!

For positive uniformity of manufacture and maximum quality.

10. TRANSFORMERS FOR EVERY APPLICATION!

Indoors, or out, Jefferson Transformers fill every demand. Normal and high power factor designs. Two lamp types are H.P.F. design. Outdoor types in deep-drawn cases for positive protection against moisture.

THESE EXTRA VALUES ARE YOURS AT NO EXTRA COST!

Only in the new line of Jefferson Mercury Lamp Transformers do you find *all* the extra-value features. You get maximum operating economy, full rated lamp life, and all around lighting satisfaction.

The extra values are yours in every model Jefferson Transformer — yet the cost is no greater than that of the ordinary transformer. Investigate now. There is no obligation.

JEFFERSON ELECTRIC COMPANY
BELLWOOD, ILLINOIS

New 16 page illustrated Bulletin 521-5 gives complete data on indoor and outdoor models for all H-1 400 watt lamps, and on the new Jefferson Transformers for both H-12 and H-15 1000 watt lamps. Write for your free copy now.

Jefferson Transformers

NEW WEARING SURFACE was applied to old, worn elevator door latch by means of nickel-silver brazing. Brazing operations were fast and easy.

COMPLETED JOB proved equal to special wear-resistant steel unit. This maintenance trick prolonged the life and stepped up the efficiency of old equipment.

Nickel-Silver Brazing Prolongs Life of Brass Latch

MAINTENANCE

By using a nickel-silver brazing rod to build up the worn surface of an elevator door latch, shutdowns were cut in half. That's the nut-shell story of a maintenance man in a Wisconsin department store who grew tired of replacing worn brass door latches on his ancient—but still serviceable—elevators.

The worn latches were a headache; not important enough to sell the owners on new equipment, yet a source of constant annoyance and frequent down time.

His answer was found in brazing; using All State Number 13 rods and Number 11 Brazaloy flux. Latches were built up to initial dimensions quickly and easily, and subsequent operation proved that wearing qualities were equal to those of special steels. And satisfactory service was accompanied by an appreciable saving.

New

P & S® WEATHERPROOF DUPLEX OUTLETS

For Complete Protection Install P & S 4527

Features . . .

NEW TYPE POSITIVE LATCHING CAP (see illustration) will not become loose, yet can be unlatched with an easy turn. No threads to cross or catch. Serrations on cap allow a firm grip.

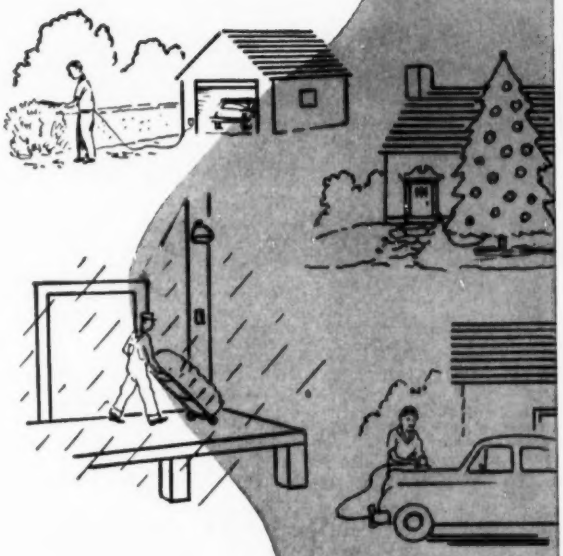
PLATE AND CAP are cast of the finest aluminum alloy, especially treated to withstand extremely severe conditions, such as imposed by Navy salt spray tests.

COMPLETE PROTECTION against the elements is insured by fine quality cover and plate gaskets.

DOUBLE GRIP OUTLET is our "13202," P&S-Despard type outlet — Meets Government Specifications.

P&S 4527 is just one device in the complete line of P&S Weatherproof Devices, featuring T-rated switches and double-grip outlets.

Specify and install these precision-built, specification type Weatherproof Devices for long-lasting, dependable service.



Write Dept. M for complete information

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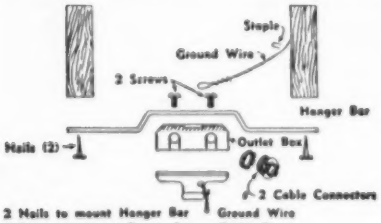
HERE'S A
NEW IDEA
in a ceiling or convenience ready-to-mount outlet... for open wiring with non-metallic systems

No. 8319 Nail Assembled Ready-to-Mount Box List Price 50c each

No. 8398 Pull Chain Lamp Receptacle Cover List Price 65c each

GREATEST ADVANCE
Since the Introduction of the outlet box!
A COMPLETELY Insulated Enclosure.

ELIMINATE ALL THIS!



2 Nails to mount Hanger Bar
2 Screws to mount Box to bar
2 Cable Connectors
P. C. Receptacle Cover
Ground Wire
Outlet Box
G.W. Staples
Hanger Bar

11 THINGS, Count 'em, ELEVEN!!

SIMPLIFY TO THIS!

1 No. 8319 Box
1 No. 8398 P.C. Receptacle Cover
} Nothing Else

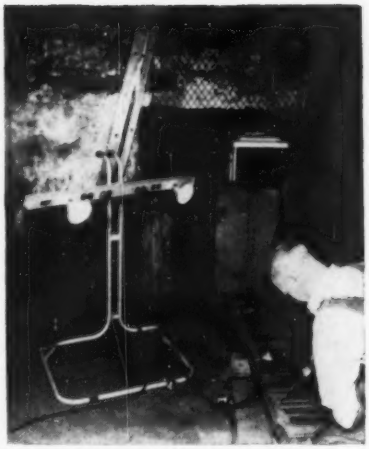
NO Hanger Bar
NO Loose Nails
NO Loose Screws
NO Connectors
NO Ground Wires
NO G.W. Staples

2 THINGS, Count 'em, ONLY TWO!!

Eliminate all grounding, all grounding hazards (see Sec. 2541 c&d, 3710c, and article 300 N.E.C.—and your local code). Saves Time. Saves Money. Simplifies inventory. Has real Sales Appeal. Best looking and SAFEST installation available anywhere. For open wiring in basements garages, cottages, attics, etc. Put in a stock now—and simplify your inventory.

PP INC.

Porcelain Products, Inc.
FINDLAY, OHIO



PORTABLE PLUG-IN strip provides light for work in dark places and multiple receptacles for power tool take-offs.

Carriage-Mounted Plug-in Strip

CONSTRUCTION

A portable plug-in strip with light and power take-offs is now finding widespread application in electrical construction work. Manufactured by National Electric Products Corp., Pittsburgh, Pa., the carriage-mounted plug-in strip combines light for work in dark places and multiple receptacles for using a number of power tools at one location.

As shown in the illustration, the unit consists of a tubular framework, with wheels on its base and handles at the top, with the plug-in duct mounted on the vertical part of the frame. The unit can be extended to a height of 5½-feet above the floor, is easily collapsed for movement, and can be obtained with several different types of plug-in duct. The duct shown provides both power and light; another has a strip for floodlighting; and a third is equipped with a strip of infra-red lighting units and several power take-offs.

Approved by Underwriters' Laboratories, Rolla-Duct is provided with a 21-foot power line of 12/3 heavy duty cable which can be safely used in damp or wet places and which is also chemical, acid, grease and oil-resistant. Each unit is fully grounded and protected with a circuit breaker incorporated in the plug-in strip. The units carry an approved rating for 20-ampere loads on 115-volt operation.

As shown in the picture, the portable unit allows convenient positioning to direct the lamps on the work and out of the workers eyes. A number of power tools can be plugged-in at one time, eliminating the usual necessity for the worker to leave the work to plug-in different tools.

LOOK FOR THIS DISPLAY AT YOUR DISTRIBUTOR'S
Inspect the New SPANGLEAM finish
TEST THIS SAMPLE
Feel -ITS LIGHT WEIGHT -ITS STRENGTH -ITS SURFACE
NOW SPANG EMT ...THIN WALL CONDUIT
WITH THE NEW
SPANGLEAM
FINISH AT NO EXTRA COST !
INSIDE IMPROVED OUTSIDE
AVAILABLE IMMEDIATELY IN THE FULL RANGE OF 6 SIZES
Easier to cut and bend ! ...faster to install !

. . . now available—at no extra cost—on Spang EMT thin wall conduit!

Check These Points:

1. NEW FINISH OUTSIDE

. . . specially-processed electrogalvanized exterior . . . highly resistant to smudge, abrasion, corrosion . . . provides neat, attractive appearance in exposed installations.

2. NEW FINISH INSIDE

. . . new smoother protective coating of resinous lacquer compounded with Zirconium . . . provides easier wire pulling, assured grounding, corrosion resistance.

3. LIGHT WEIGHT—STRONG

. . . the same Spang top-quality EMT thin wall conduit . . . easy to cut, bend, install; built from high-grade steel for years of service in permanent installations . . . BUT, now with the SPANGLEAM finish it's cleaner, easier to handle, easier to maintain.

4. AVAILABLE

. . . SPANGLEAM finish is available immediately in the full range of six sizes—½", ¾", 1", 1¼", 1½" and 2".

LET SPANGLEAM HELP YOU

- make better installations
- make work easier
- build profits

TAKE A LOOK AT SPANGLEAM TODAY! THEN TRY IT!

SPANG CONDUIT

SPANG-CHALFANT
Division of The National Supply Company
GENERAL SALES OFFICE:
PITTSBURGH 30, PA.
District Offices and Sales Representatives in Principal Cities

Cramped for space?

Try Black & Decker Power!

You can't beat B&D for top-speed drilling in tight spots!

Black & Decker ¼" Heavy-Duty DRILL *Only* **$52.50**

Black & Decker ⅜" Standard DRILL *Only* **$55.00**

STOP complaining about close-quarter work in corners, closets, joists and rafters! DO something about it—switch to Black & Decker power! Compact, easy-to-handle B&D end-handle drills get you in and out of tight spots in a hurry! They drive twist drills, wood augers, masonry bits and smaller Hole Saws . . . make short work of BX installations, mounting boxes and cut-outs, making service entrances, etc. And they're quality-built for long, faithful service by the world's largest manufacturer of portable electric tools!

See your nearby Black & Decker Distributor for a demonstration. For free catalog, write to: THE BLACK & DECKER MFG. CO., 617 Pennsylvania Ave., Towson 4, Maryland.

*Trade Mark Reg. U. S. Pat. Off.

B&D ¼" Heavy-Duty HOLGUN* *Only* $44.00

- 25% more power—can't be stalled at rated capacity
- Weighs only 3¼ lbs.; measures only 7¼" overall
- New handle shaped for plenty of finger room

LEADING DISTRIBUTORS EVERYWHERE SELL

B&D Black & Decker PORTABLE ELECTRIC TOOLS

PAPER TENSIOMETER installed between calenders, shown mounted on adjustable lead screw to take care of different pass lines, is used for automatic tension control on this paper machine at P. H. Glatfelter's Spring Grove, Pa. paper manufacturing plant.

Paper Tension Controlled Electrically

PRODUCTION

Greater paper production and less "down time" due to paper breaks has been accomplished at the Spring Grove, Pa., plant of the P. H. Glatfelter Company through the installation of electrical controls for checking tension.

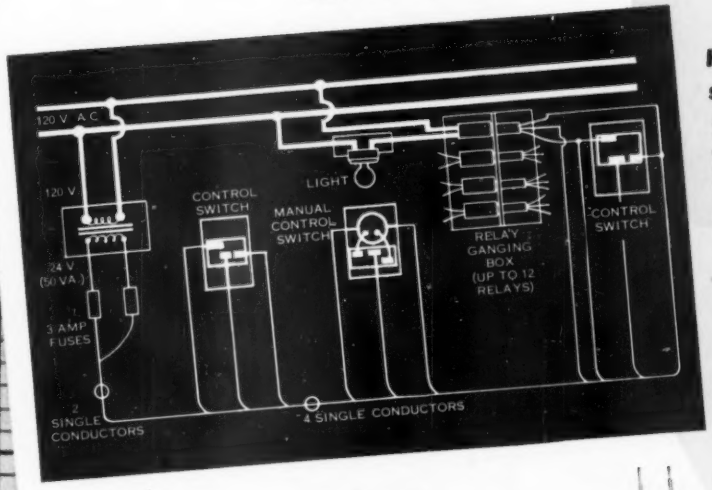
Since processing paper races between the calender rolls at 100 feet a minute, breaks resulted not only in lost time but waste and production inefficiency as well. This problem was formerly controlled indirectly by automatic regulation of section motor speed or section motor current, but this approach was not entirely satisfactory.

With the addition of a G. E. paper tensiometer, Glatfelter can maintain constant tension regardless of changes in any of the variables affecting this factor, such as freeness, consistency, dryer temperature, moisture content, calender stack loading or friction load variations. Combined with the tensiometer is a G. E. electronic amplidyne sectional drive, providing automatic control. The tensiometer utilizes only one very short roll and thereby does not complicate the paper threading of the machines.

In operation, the small, 4-inch roller of the tension head rides on top of the moving sheet of paper so that a slight dimple is depressed into the sheet. Variations in the sheet tension change the air gap of a magnetic structure inside the device which emits an electrical signal proportionate to the papers tension. This is transmitted through the power unit which contains the metering circuits, and controls.

The Swing is to LOW VOLTAGE CONTROL

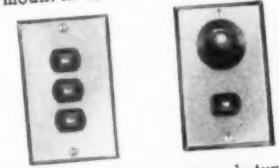
. . . and you'll prefer SQUARE D for a lot of reasons



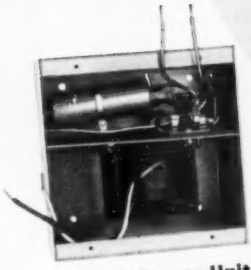
Here is a low voltage remote control system with all the features you've wanted . . .

Because it saves so much installation time, the cost of this very flexible system compares favorably with conventional systems. Actually less, in many cases. It offers a super-convenient means of switching lighting and appliance circuits. It has scores of applications—in homes, office buildings, schools, churches, warehouses, factories.

Relays are extremely rugged. 20 amperes, 120 volts A.C. Also 20 amperes, 277 volts A.C. for low voltage control of high voltage fluorescent lighting. All relays mount in ½" knockouts.



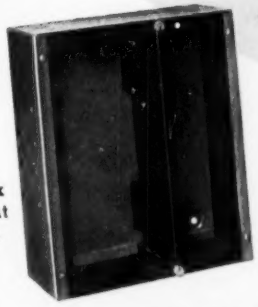
Control Switches are toggle type and fit Despard plates and straps. One, two, or three control switches (*left, above*) or one **Manual Selector Switch** and one control switch (*right, above*) can be mounted on a single strap. Manual selector switch controls from 1 to 9 circuits. Key-operated switch also available.



D.C. Power Unit, designed for consistent and trouble-free service. Eliminates A.C. hum.

Relay Ganging Box for speedy, convenient and quiet installations.

Master Controller automatically controls up to 23 individual circuits from any location.



Write for Low Voltage Control Bulletin.

Address Square D Company, 6060 Rivard Street, Detroit 11, Michigan.

ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS

SQUARE D COMPANY

1903 · 50 YEARS OF DESIGN LEADERSHIP · 1953

DONGAN POWER CIRCUIT TRANSFORMERS

Save Critical Materials
In the Lighting and Operating of Machine Tools

DONGAN Transformers solve the problem of providing low voltage circuits for the lighting and operating of control circuits on machine tools without installing separate lines. Simply run a branch line from the power line, using a transformer to reduce the voltage.

Quicker installation, at lower cost, with less labor and less critical materials. Keep this in mind when you have work of this character.

WRITE FOR CATALOG

DONGAN ELECTRIC MFG. CO.

2980 Franklin Detroit 7, Mich.

The Dongan Line
Since Nineteen-Nine

DONGAN TRANSFORMERS

According to the company's engineers, the tensiometer gives continuous and accurate indication of the tension variations without damage to the sheet, it is easily adjusted and simple to maintain, it can be used for automatic control, and its fast response time permits its use on the highest speed paper machines.

Antenna Reflectors Kept Ice Free By Heaters

BROADCASTING

The problem of keeping ice from forming on television and microwave antenna reflectors through the winter months has given broadcast engineers many a headache in past years. But now they can replace the aspirin bottle in the medicine cabinet, for Workshop Associates, a division of the Gabriel Company in Needham Heights, Massachusetts, is successfully eliminating impaired performance of parabolic reflectors due to ice formation by the installation of Calrod tubular heaters on the rear of the reflectors. These heating elements quickly transform ice to water, and drain holes keep the water off the reflector surfaces.

The heaters, rated variously between 500- and 2000-watts depending upon geographical location of the tower and prevalent weather conditions, are first assembled and placed in a false back where they rest on asbestos pads. These backs, containing two 126-inch coiled lengths of Calrod tubular assemblies, are then mounted on the back of the reflectors and the parabolic unit is then ready to stand up under the blows of Old Man Winter.

TUBULAR HEATING ELEMENTS are assembled in false backs which fit over parabolic reflectors subjected to the rigors of winter and ice formation. Heaters prevent formation of ice and materially improve antenna performance.

Startling new connector performance...

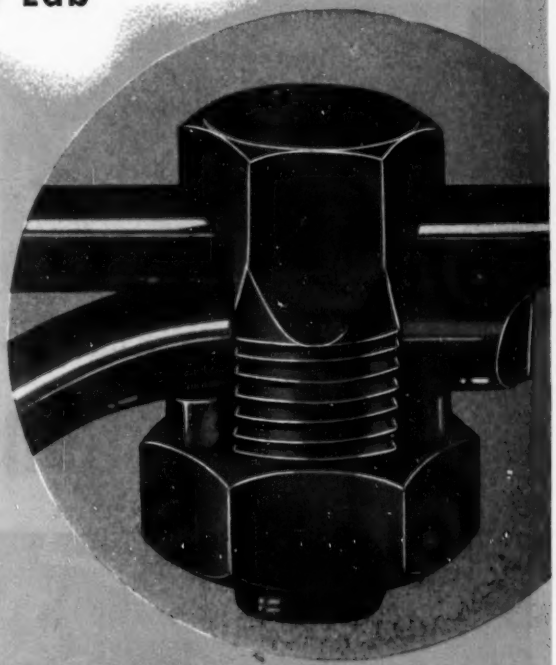
from the Chemistry Lab

Here's News!...
BLACKBURN has perfected an amazing new and exclusive chemical process—the CFC Process*—which drastically reduces thread friction... Result—over 25% increase in clamping force, to make the outstanding BLACKBURN Connector even better.

Tests show that high pressure connections on copper conductor have lower resistance—stay tighter—and give you lasting, trouble-free service.

This new discovery means that every BLACKBURN Hi-Strength Connector for copper connections *makes* and *holds* a *maximum-pressure* connection—an absolutely dependable connection that will stay tight and trouble-free year after year.

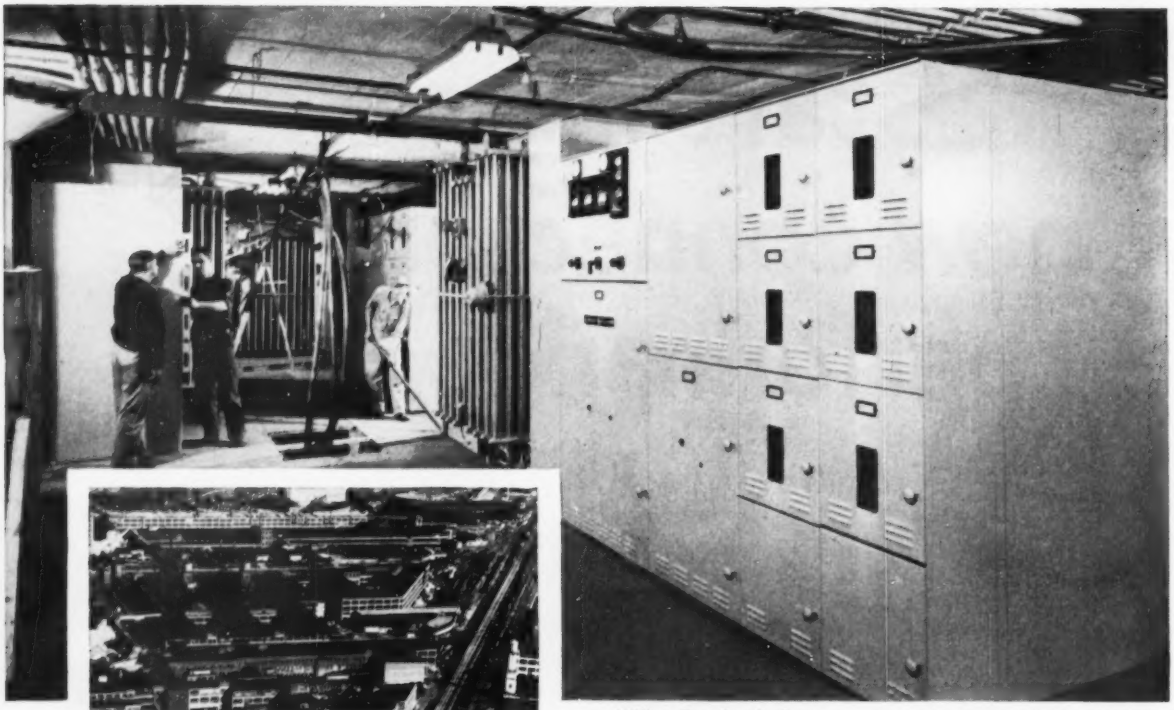
**Chemical Friction Control Process—Patent Pending*



CFC Processed for improved high-pressure connections

BLACKBURN *Hi-Strength* CONNECTORS

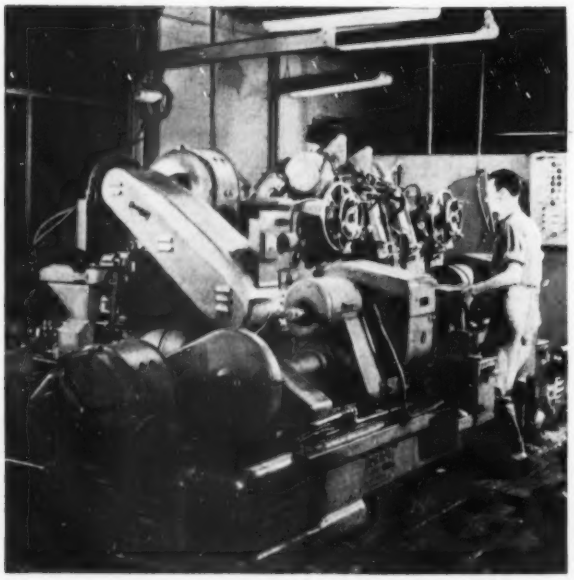
JASPER BLACKBURN CORP., 35 Madison St., St. Louis 6, Mo. • Phone CEntral 3007



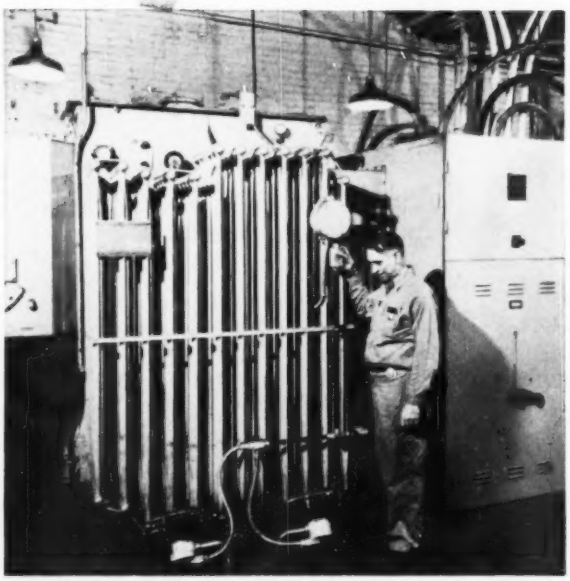
Willys-Overland plant, covering 103 acres (at left) in Toledo, O., adds five new G-E unit substations to expand simply and easily its radial distribution system. Total plant capacity is now 26,000 kva. Three of the 1,500-kva subs (above), with two others, furnish power to aircraft landing gear division.

AT WILLYS-OVERLAND—

One of nation's first load-center

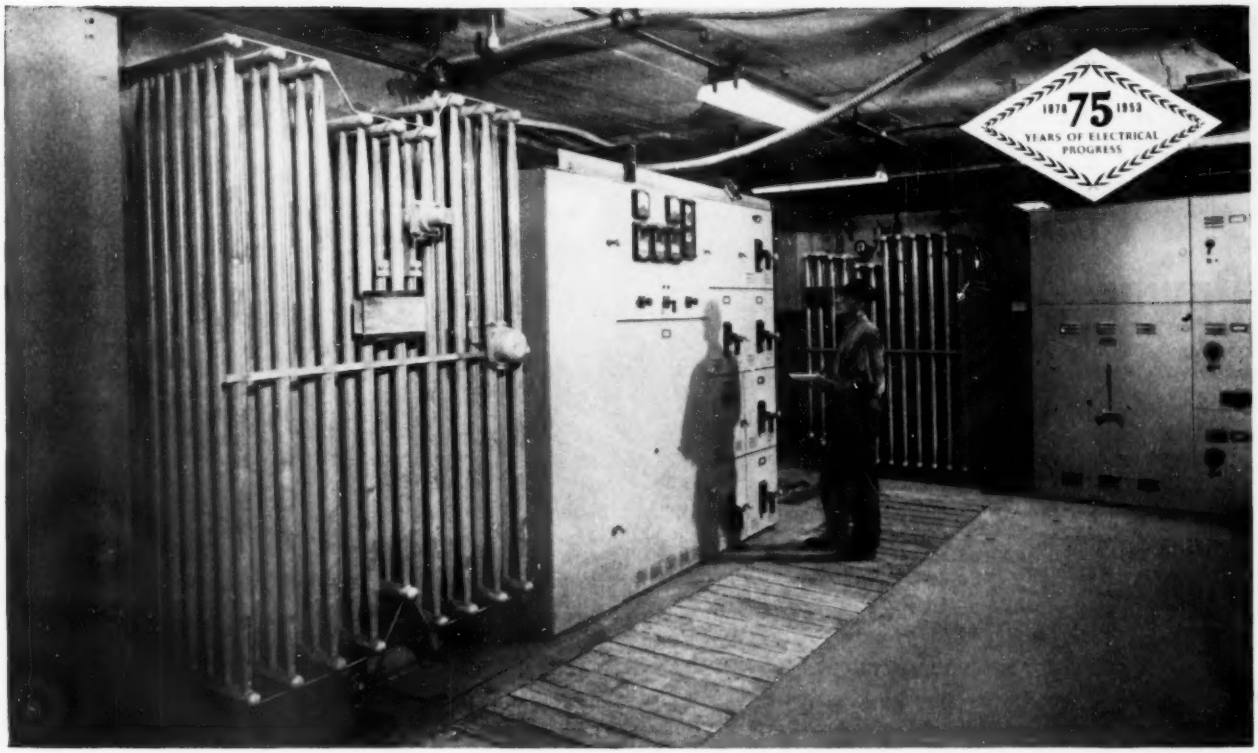


Grinder for crankshaft pin bearings is powered by a G-E unit substation, 4160-volt to 440-volt, which is located just beyond screen at left, adjacent to the load area.



Installed since 1945, when original system was expanded, G-E unit substation, with Pyranol* transformer, has been operating 24 hours a day, 5 days a week, with low maintenance cost.

*Reg. Trade-mark of General Electric Co.



New load-center units, are added to system which has operated for 13 years without power failure. Addition of new substations, like the two new 1,500-kva units above, does not alter over-all system, provides high degree of flexibility to handle shifts in plant loads. Unit subs, used as building blocks, can be placed wherever needed.

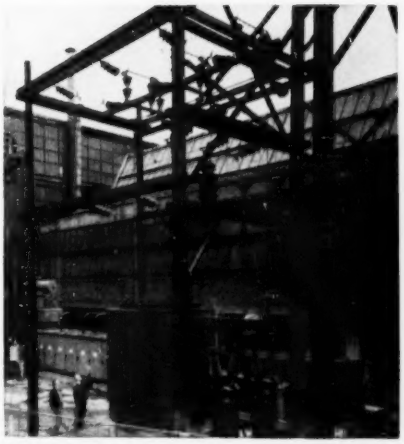
systems: Never a power failure!

G-E radial distribution system, installed in 1939, easily expanded to 26,000 KVA for increased plant loads

Flexibility in reliable power distribution for stepped-up production of Jeeps . . . quick, easy power expansion at little expense . . . low-cost maintenance with maximum safety. The Willys-Overland Company in Toledo found these advantages of its plant's radial distribution system multiplied when five new G-E 1,500-kva load-center substations were added recently for greater plant capacity.

During the past 13 years of trouble-free operation, engineers have had first-hand experience with the low cost, simplicity, and reliability of the radial system. A G-E outdoor unit substation furnishes plant power, steps down utility voltage to a usable 4,160 volts. Eighteen unit substations handle load requirements in more than two-score buildings on the 103-acre tract.

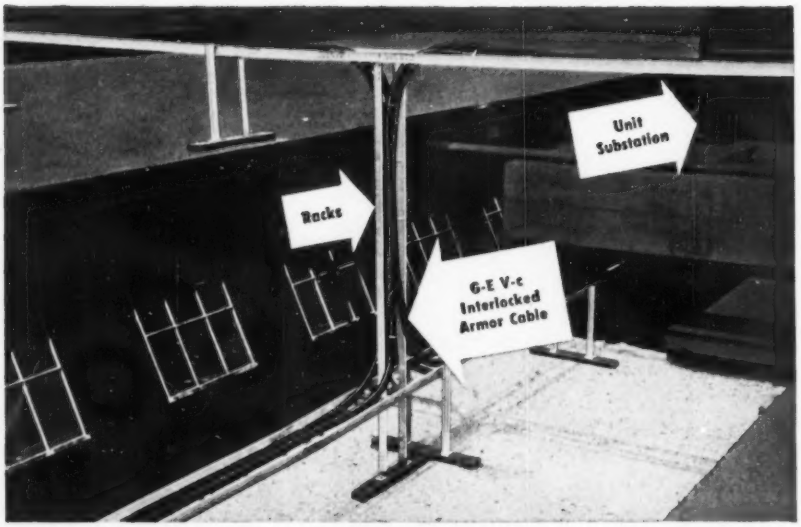
This installation is just one example of the way G-E engineering helps industry meet demands for more power. For further information, contact your G-E sales representative, or write for GEA-3592. General Electric Company, Schenectady 5, New York. 881-1



Outdoor G-E master unit substation, plus an indoor G-E station, furnishes power for 90 per cent of Willys-Overland capacity.

GENERAL ELECTRIC

How to Modernize a Plant's Power Supply System in a Hurry



Utilize existing structures... and the G-E V-c INTERLOCKED ARMOR CABLE SYSTEM

To distribute power in a modernized plant, an eastern manufacturer used 12 G-E unit substations on the roof and then installed a G-E V-c interlocked armor cable system to bring high-voltage power to these substations. More than a mile of G-E V-c interlocked armor cable was used. The cable was 3-conductor #2/0, 15,000-volt, No. 1799 varnished-cambric-insulated with a thermoplastic jacket and bronze armor.

Underground duct work would have meant costly tearing up of concrete floors. And an ordinary conduit installation was not feasible because of the uneven contour of the buildings' roofs. Either of these methods also meant more installation time and more cost for materials.

Aluminum racks

Aluminum racks, only 12 inches wide, were used to carry the cable over the many rises, slopes, and bends on the roofs. Because the G-E V-c interlocked armor cable system is light and flexible, no difficulty was experienced in pulling long lengths by hand over and around the bends and angles.

Easy to inspect

G-E V-c interlocked armor cable on racks is always open for visual inspection — always accessible — quickly spliced with simple mechanical joints. To our knowledge, no installation of G-E V-c interlocked armor cable has ever suffered mechanical damage sufficient to cause electrical failure. It will pay you to investigate the G-E V-c interlocked armor cable system. For more information, write Section W64A-318, Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.

Easy to bend.
Corners and projections present no installation problems for the G-E V-c interlocked armor cable system.

ESTIMATED INSTALLED COSTS FOR 15,000-VOLT CABLE

	Conductor Size	Method of Installation	Amperes*	Installed Cost per 100 Feet per Ampere
Varnished Cambric Insulated Interlocked Armor Cable	**2/0**	**Racks**	**185**	**$2.80**
Rubber-Neoprene	3/0	Steel Conduit	197	4.20
Rubber-Neoprene	1/0	Messenger	182	3.10

*Based on 77 C copper for V-c and 80 C copper for rubber-insulated cables at 40 C ambient.

You can put your confidence in—

1878 75 1953 YEARS OF ELECTRICAL PROGRESS

GENERAL ELECTRIC

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CATALOGS, BULLETINS
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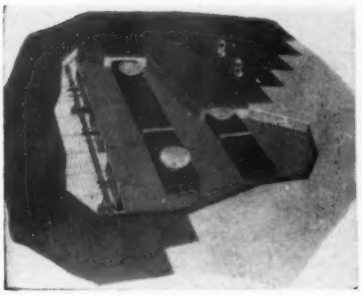
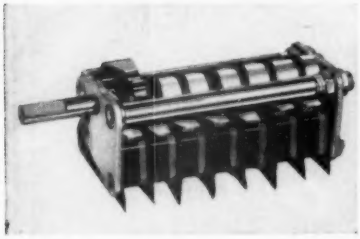
Product News



Electrified Steel Floors (1)

A new electrified steel panel subfloor known as Fenestra-Nepco electrifloor. The electric header duct system is an all-steel grounded raceway from the distribution outlet to the structural steel floor panels. Electric wiring through this combined raceway system provides the availability of electric outlets in any square foot of floor area. Cellular panel formed by spot welding a steel flat surface to integral steel web members of a formed beam section. Side-laps interlock. Cellular raceway is used for installation of electrical wires for power, light, telephone and intercommunications. Junction unit provides accessible hand hole area for ease of pulling, bending and splicing branch circuit conductors. Joists and metal lathing are eliminated in the construction of the electrifloor. The subfloor is composed of unit panels which can be welded together in any combination desired by the architect. Each of the panels can be carried by two workmen and the strength and smoothness of the sections permits working traffic on the floor during installation. It has been approved and listed by Underwriters' Laboratories, Inc.

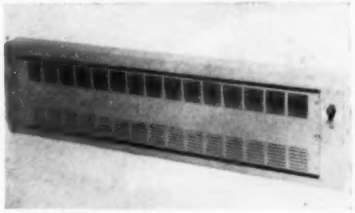
National Electric Products Corp., Chamber of Commerce Bldg., Pittsburgh 30, Pa. and Detroit Steel Products Company, Detroit, Mich.



Switch Assembly (2)

A new series of small size multiple rotary switch assemblies, designed especially for aircraft use but adaptable to a wide variety of either ac or dc switch applications. One of the series is a ganged assembly of seven Micro "V3" type basic switches with single-pole, double-throw contact arrangement. Each "V3" basic switch measures $\frac{13}{32}$ by $\frac{5}{8}$ by $1\frac{3}{32}$ inches, and entire assembly measures $1\frac{1}{2}$ by $1\frac{5}{16}$ by $4\frac{3}{4}$ inches. The dc rating of the 7AS71 assembly for inductive and heater load is: 30 volt, 10 amperes at sea level; 30 volt, 6 amperes at 50,000 feet altitude. The ac rating is 125 or 250 volts, 10 amperes. Other variations are available in from three to eight gang assemblies of "V3" type single-pole, double-throw basic switches and from two to eight switching positions at 45 degrees angular rotation between positions. Applications of new series, in addition to lighting control, include aircraft landing gear indicators, X-ray and electronic equipment and aircraft electric windshield wipers.

Micro, Division of Minneapolis-Honeywell Regulator Co., Freeport, Ill.



Electric Baseboard Unit (3)

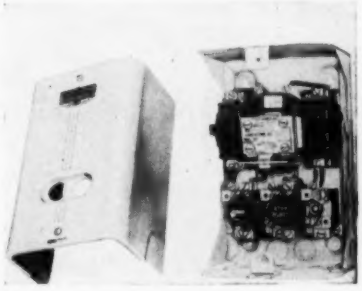
A new Circle Air convection electric baseboard unit which is completely self-contained. It is available in three models all 10 inches high and 3 inches deep. Lengths are 28 inches, 36 inches or 48 inches, and they can be recessed to lie flush with baseboard, or can be installed standing free from wall. Available with built-in single pole thermostat. Units employ a "fin" type heating element. Air is warmed evenly and circulated through room by natural convection principle. Wattages for three models are 700, 1050 and 1400. All models available in 155 and 230 volts.

Paley Manufacturing Company, 244 Herkimer St., Brooklyn 16, N. Y.

Insulating Varnish (4)

A new electrical insulating varnish, designed especially for equipment where high speeds and/or intense vibration normally would cause wire movement and resultant electrical failures. Known as Irvington No. 140, it was specifically formulated to meet exceptional standards of mechanical strength. It is resistant to oils, chemicals and moisture. Naphtha can be used for thinning.

Irvington Varnish & Insulator Co., Irvington, N. J.



Starter (5)

A new line of magnetic starters, contactors and relays, which incorporates a 5 unit construction. A wrap-around cover pulls off, exposing front and both sides of unit for 180° accessibility. The 5 independent parts consist of two contact blocks, a magnet coil, and armature and a 3-coil or 2-coil overload relay mounted on a steel panel. Each part can be removed from front without disturbing another part. The line features a 3-coil, adjustable overload relay permitting 4 ratings from each heater coil by changing its position. All terminals are angled to face front, and are equipped with solderless connectors that take a vise-grip on solid or stranded wire, or both, or wire of different sizes.

Cutler-Hammer, Inc., 315 N. 12th Street, Milwaukee 1, Wis.

Grounding Devices (6)

New 3-wire grounding devices carry a rating of 15 amperes, 250 volts and have tandem slots in the receptacles and tandem blades in the caps. They can be used with metallic or non-metallic wiring systems. Grounding of metallic wiring system is directly through metal enclosure. Grounding of non-metallic systems is through a third wire acting as a grounding connector. "U" shaped slots take grounding blade. These grounding outlets are designed with holes for back wiring as well as binding screws for side wiring; wire strip gauge; break off feature for two-circuit installations.

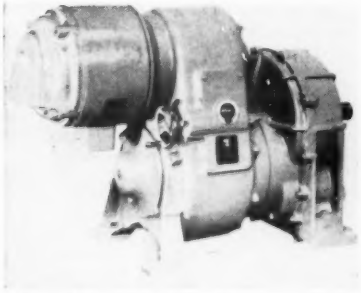
Harvey Hubbell, Inc., Bridgeport, Conn.

Patent Pending
"UCOM" No. 690
UNIVERSAL COMBINATION
COUPLING FOR THIN
WALL CONDUIT
MW
Midwest Electric Mfg. Company
MANUFACTURERS OF ELECTRICAL WIRING PRODUCTS
1639 W. WALNUT STREET
Chicago 12, Illinois

Rheostat (7)

A new motor-operated field rheostat, used to adjust speed of dc motors up to 200 hp and voltage of generators up to 300 kw. Called Type RK, it uses snap-action limit switches. Two cam-operated switches are supplied with each unit, with additional switches available for auxiliary circuits. Each cam is adjustable over 360° range from front of rheostat, and is available for 15- 45- and 90-degree travel. Two different gear ratios can be supplied: one permits full rheostat travel in from 5 to 15 seconds; the other full travel in 15 to 45 seconds. Travel time can be adjusted over a 3-to-1 range by inserting resistance in motor circuit. Drive mechanism mounts on front panel, up to three standard rheostat plates can be mounted on rear of panel, and all components are accessible for inspection or adjustment.

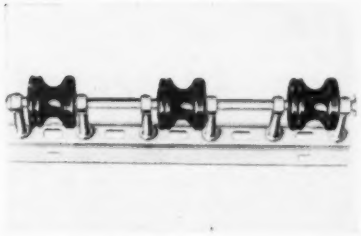
Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa.



Variable Speed Drive (8)

A new type KFEB double reduction 20 and 25 hp Speed-Trols with speed variation of 2:1, 3:1 and 4:1. The 20 hp type 364 KFEB is available with maximum speeds ranging from 176 rpm to 42 rpm and the 25 hp type 365 KFEB with maximum speeds ranging from 176 rpm to 64 rpm. Drip-proof and splash-proof models feature direct-through ventilation system. Totally enclosed, fan cooling model provides a dual cooling system for internal and external cooling. In this latter model, air inside motor is continously circulated by large diameter internal cooling fan through large unobstructed air passages between motor housing and stator, over motor windings, and through openings in motor. Heat from motor is dissipated by triple action of convection, conduction and radiation to outside of motor. Much of the heat is carried off by a continuous flow of cooling air forced over motor housing by an external fan and removable grilled fan cover.

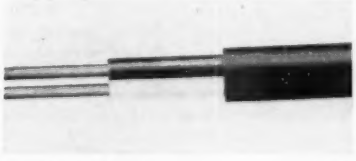
Sterling Electric Motors, Inc., 5401 Anaheim-Telegraph Road, Los Angeles 22, Calif.



Secondary Racks (9)

A complete line of light, medium and heavy duty secondary racks which conform with EEI Specification TD-7. The medium and heavy duty types have a forged-leg design which eliminates all pockets. The medium duty rack has sufficient strength for most urban area construction jobs. Heavy duty racks are recommended for use where construction standards require superior strength. All edges of racks are rounded and they are hot-dip galvanized. Racks are available for two, three or four wires, with extended or non-extended back, with spacings of 4-in, 8-in. or 12-in.

Line Material Company, Milwaukee, Wis.



Plastic Cable (10)

A new plastic-insulated pole-and-bracket cable for street lighting. Voltage rating is 600 volts between conductors; 6000 volts from conductor to ground. Construction consists of two flexible stranded conductors; each insulated with Densheath (PVC); one black and one white, laid parallel; black polyethylene jacket; finished cable oval-shaped. It is available in the following sizes: 2/C—No. 10 AWG—19 strands, 0.43-in. by 0.64-in.; 2/C—No. 8 Awg—37 strands, 0.46-in. by 0.71-in.; and 2/C—No. 6 AWG—37 strands, 0.50-in. by 0.81-in.

Anaconda Wire & Cable Co., 25 Broadway, New York 4, N. Y.

Pump Island Light (11)

New fluorescent pump-island lite covers the entire gas station service area with glare-free optically engineered illumination. The shielding cover is sealed against leakage and protects sockets, lamps and wiring from wind, rain, hail, sleet, snow and sun. In addition, outdoor type ballasts, wiring and sealed sockets are weather resistant. Installation on island poles is simple and quick, and fixture is adapted to take cluster light units of any style. Interior is finished in high-reflectance baked white enamel, exterior in colors as desired to conform with any color scheme.

Fluorescent Fixtures of California, 345 Franklin St., San Francisco, Calif.

Emergency Lighting Unit (12)

A new redesigned automatic emergency lighting unit, which assures instantaneous light when regular power fails. It was designed primarily for industrial plants, laboratories, hospitals, hotels, institutions, theatres, etc. Unit is powered by a storage battery built into the portable set. A trickle charger automatically maintains the charge of the battery. A built-in hydrometer indicates the state of the battery at a glance. It plugs into any ac circuit. Lights are sealed beam of 100 C.P. and will provide ten hours of light.

General Scientific Equipment Co., 2700 W. Huntingdon St., Philadelphia 32, Pa.

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equipment you can rely on

Talk to any old-timer on the job and he'll tell you Klein equipment is his choice for comfort—for safety—for service. Look for the familiar Klein trade-mark on pliers, safety straps and belts, climbers, grips and wrenches. Klein has been serving the electrical industry "Since 1857."

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Foreign Distributor: International Standard Electric Corp., New York

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Mathias KLEIN & Sons
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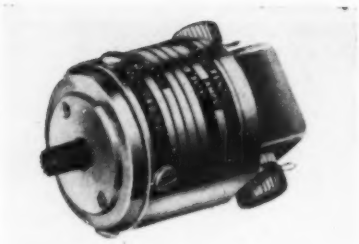
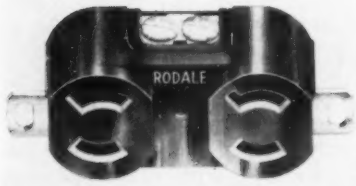
3200 BELMONT AVE. CHICAGO 18, ILL.



Motors (13)

New permanent magnet motors with symmetrical armature winding. Speeds obtainable range from 5,000 to 20,000 revolutions per minute. Motors for 6 to 115 volt dc operation can be supplied. At a short duty cycle, up to 65 milli-horsepower is attainable for 26 volt applications. Dynamic braking stops motor from 10,000 rpm in approximately 10 revolutions. BYLM 40000 frame size is 1½-in. in diameter by 2 3/16-in. in length. Motors are for industrial and aircraft applications such as electro-mechanical actuators, generators, dynamotors, gear-head motors, fan and blower drives, and rapid transfer switches.

Barber-Colman Company, Rockford, Ill.



Duplex Flush Receptacle (14)

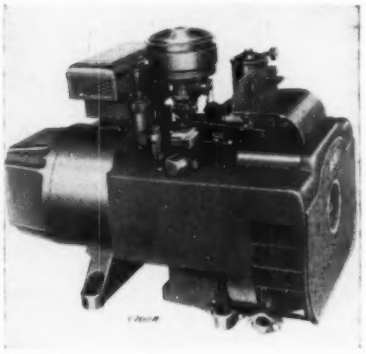
Catalog No. 1022 was specially designed to handle heavy industrial loads with trouble-free safety. Made of molded bakelite, this standard size will accommodate polarized or non-polarized Turn-Tyte caps and standard duplex receptacle plate. Equipped with extra large binding-head screws. Rated at 10 amp, 250 volts, and 15 amp, 125 volts. Listed by Underwriters' Laboratories.

Rodale Manufacturing Co., Inc., Emmaus, Pa.

Welder (15)

A redesigned 300-ampere ac welding transformer, featuring stepless current selection from 40 to 375 amperes. The welder incorporates an enlarged scale and finely threaded screw adjustment to facilitate easy current selections. It accommodates electrodes from $\frac{3}{32}$ to $\frac{1}{4}$ in. diameter, and has a handy range switch which enables the operator to change quickly from high to low or low to high range. Arc-stabilizing capacitors contribute toward increased production by enabling operator to strike and maintain an arc without popouts. Extra protection against high temperature coil failure is provided by silicone insulation. Welder is 36-in. high, 21-in. in diameter, and weighs approximately 328 lbs.

General Electric Company, Schenectady 5, N. Y.



Generating Plant (16)

Air-cooled, gasoline-powered electric generating plant, designed the "CW" model. Available in 5,000- and 10,000-watt capacities. Its new vacuum cooling system employs a centrifugal blower which draws cold air through the generator and over the engine, and at the same time discharges heated air out of an 8-in. by 12-in. side vent. For suburban homes and farms, depending completely on electricity, the "CW" models provide maximum standby protection at low cost. It will operate hot water heaters, oil burners or stokers, water systems and sump pumps, freezers, refrigerators, lights and other appliances. It provides ample standby capacity for larger homes, estates, clubs and resorts. On construction jobs and other projects where electric power must be supplied independently, they meet the requirements of portability and heavy-duty service. Readily trailer mounted, or carried on small pickup trucks or other conveyances, they furnish power for floodlights, tools and other needs.

D. W. Onan & Sons, Inc., Minneapolis 14, Minn.

Televoice System (17)

A new industrial televoice system, known as a plant "fact-conveyor". It deals with the conversion of spoken thoughts into written communication by means of a series of special dispatching phones connected to a central recorder. System provides means for transmitting essential up-to-the-minute information from production floor to production management in typewritten form. System is designed to speed and simplify in-plant routine and to promote faster, more careful handling and analysis of problems.

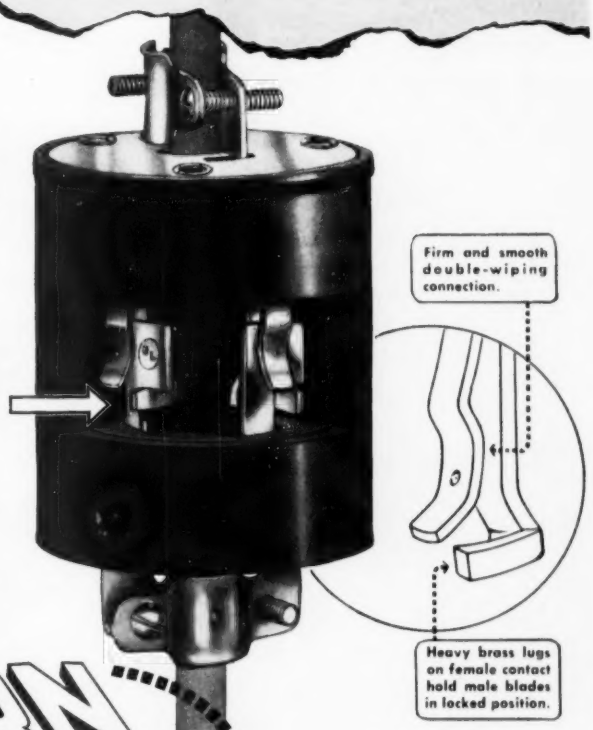
Thomas A. Edison, Incorporated, West Orange, N. J.

First major improvement on interlocking devices in 20 years!

TURN-TYTE's new safety factor*

UL PATENT APPLIED FOR

in the first ALL-RUBBER interlocking CONNECTOR



* CAN'T DISCONNECT when in locked position. Male blades engage special lugs on female contacts to form a safer, double-locked connection under the most trying conditions. Eliminates usual strain on connector body and danger of chipping, breaking, wearing away.

Interchangeable with all other makes

SHOCKPROOF . . .

Drop it, stamp on it, subject it to extreme vibration, roll a heavy weight over it! The tough all-rubber body won't give . . . the protected contacts won't be harmed . . . the electrical connection will remain intact. Eliminates all danger of electrical shock.

STRAINPROOF . . .

Try to pull it apart! The locked connection will hold under the severest manual or accidental strain. The all-rubber body is tested to a tensile strength of over 1200 lbs. per square inch.

WEATHERPROOF . . .

The all-rubber body affords moisture-proof safety under extreme atmospheric conditions. Will not crack, warp or deteriorate. All metal parts specially coated to resist rust and corrosion.

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SPECIALLY DESIGNED

to meet the demanding requirements of Packing Plants, Breweries, Fire Departments, Distilleries, Bottling Works, Dairies, Mines, Tunnels and a wide variety of other industrial users.

Now available AT YOUR WHOLESALER in 2, 3 and 4 wire models

Ask for

#2109—2 wire, 10 amp.
#2209—2 wire, 20 amp.
#3109—3 wire, 10 amp.
#3209—3 wire, 20 amp.
#2409—4 wire, 20 amp.

All equipped with Rodale patented cord clamps

Underwriters' Listed and CSA Approved

FREE SAMPLE AVAILABLE if requested on your company letterhead

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RODALE MANUFACTURING COMPANY, Inc.
Dept. 302, Emmaus, Pa.

Please send:

☐ Sample of New ALL-RUBBER CONNECTOR.

☐ Complete catalog of 600 Rodale Standard Wiring Devices.

☐ Complete catalog of TURN-TYTE and Heavy-Duty Connectors, Caps, Receptacles.

Attention: Mr. .....

Title: .....

Rodale MANUFACTURING COMPANY, Inc., Dept. 302, EMMAUS, PA.

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switchgear
(drawout or stationary)

panelboards

feeder & plug-in bus duct

"Concentrol" motor control centers

instrument panels

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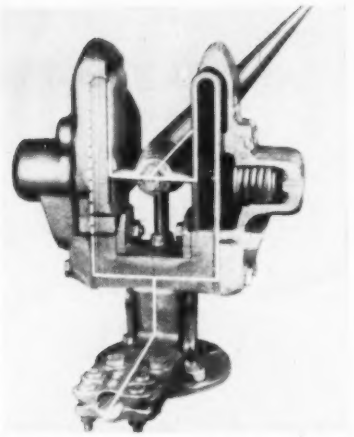
Before you decide on any Electrical Distribution Equipment, be sure you have Continental's engineered proposals and delivery schedules! Your inquiries will be given prompt attention . . . and Continental's standardized equipment will get you into action . . . fast!

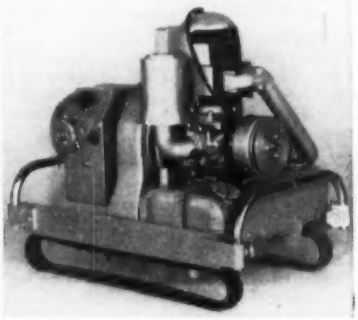
Specify Continental . . . with Confidence!



Contact (18)

A new air break switch contact design that utilizes the magnetic fields surrounding current carrying members to effect higher contact pressure. Called "Amplitact", the contact responds to any increase in current flow with a proportionate increase in contact pressure resulting in greater current carry capabilities. Under fault conditions high contact pressures are developed. It employs spring pressure for normal current plus pressure generated by magnetic forces. The "Amplitact" is available on heavy duty type WAG switches where short circuit requirements exceed the capabilities of standard switches.

Southern States Equipment Co., Hampton, Ga.

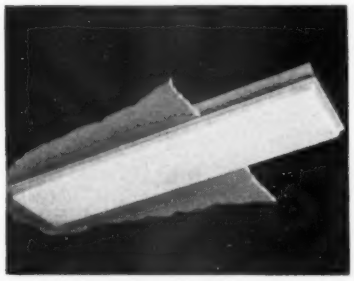


Generator (19)

A new dual-voltage 5 kilowatt carryable generator. Model 32A115/230-1, will carry a continuous load of 5,000 watts, single-phase, 60 cycle ac at either 115 or 230 volts. It has enough power to start and operate a variety of electric tools and equipment such as electric saw, grinders, drills, routers, tampers, in the construction and transportation fields, and for emergency lighting and standby power for municipalities, communication companies, farms, homes, etc. A 115 volt ac standard convenience outlet is supplied, together with a special waterproof 3-pole receptacle for connecting either 115 or 230 volt motors, tools and appliances. Generator has specially impregnated ar-

mature and coils to give high resistance to oil, moisture, and abrasive dust. Armature is keyed to engine crankshaft. Voltage regulation from no load to full load is approximately 4%. Dimensions are: 29-in. long, 24½-in. wide, 25½-in. high. It weighs 228 pounds.

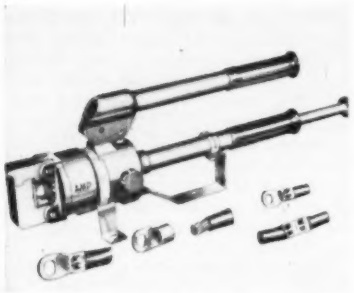
Homelite Corporation, 67 Riverdale Ave., Port Chester, N. Y.



Lighting Fixtures (20)

The new "Luminette Line" of fixtures features the Neo-Rex Acrylic plastic bottom. This new line is available in 4 ft. long, 8 ft. long and 2 ft. square units. Units are totally enclosed. Fixtures are engineered to combine modern appearance and design without sacrificing efficiency. Included in the line are fluorescent and slimline, recessed and surfaced mounted. The Acrylic Neo-Rex shield will not discolor and snaps in and out with ease.

Neo-Ray Products, Inc., 315 East 22d Street, New York 10, N. Y.



Hand Hydraulic Tool (21)

Improvements have been made in the AMP hand hydraulic tool, which crimps heavy duty solderless terminals to stranded or solid wire. Unit has interchangeable die inserts for eight wire sizes from No. 8 to No. 4/0. Tool head, in which crimping dies are inserted, has been redesigned and provided with a spring-loaded latch. Head has 360° axial rotation to permit crimping of terminals to cables in cramped or awkward locations. A cradle is provided as standard equipment, which permits its use as a bench tool. A strap may be passed through a slot in cradle for supporting tool on a pole, enabling operator to use both hands.

Aircraft-Marine Products, Inc., Harrisburg, Pa.

The Features You Asked for:

the NEW Super Safe IDEAL Voltage Tester

Thousands of Electrical Men Told Us What They Wanted — We Included Every Major Feature — No Other Tester Offers So Many Advantages for Easier, Safer Use:

NO OTHER TESTER HAS ALL THESE:

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Coil layer-wound on rugged nylon spool for long, safe life

Molded rubber, moisture-tight prod handles— "No-Slip" safety rings; 30" neoprene leads

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. . . a solenoid, calibrated indicator AND a neon test lamp, each independent of the other — NO CHANCE OF FAILURE TO DETECT VOLTAGE.

TESTS 110 to 550 Volts AC — 110 to 600 Volts DC

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NEW E. M. T. SET SCREW FITTINGS SAVE INSTALLATION TIME ...GIVE LASTING GRIP

These new EFCOR Set Screw Connectors and Couplings make possible amazing labor and material cost savings in non water-tight installations. One turn of set screw locks the E.M.T. firmly into place.

No Special Tools Needed—Installations which are inaccessible with an open end wrench are now quickly, easily accessible with an ordinary screwdriver!

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DENOTES BINDING SURFACE.
Efcor Case Hardened Cup Screws lock tubing more securely than conventional pointed screws because they bind a greater surface area of tubing.

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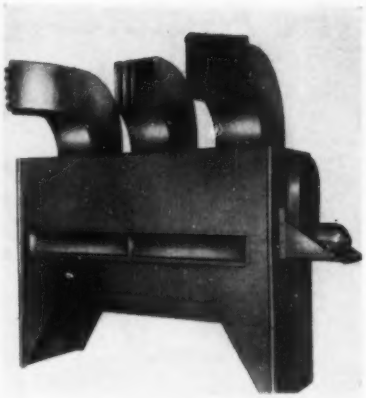
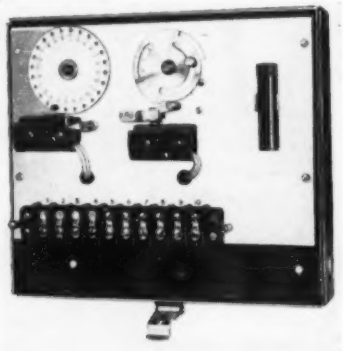


Industrial Heaters (22)

An improved line of industrial heaters, which deliver large volumes of heated air for heating large areas which cannot be heated by more conventional methods. The self-contained units, which range from 100,000 to 2,500,000-Btu per hour in heating capacity and from 2,000 to 25,000 cfm fin air velocity, may be floor, wall or ceiling mounted. They may be mounted in either upright or inverted position when wall mounted. The new line includes a heavy duty model designed especially for steel, rubber and paper mills. Accessories available include filter boxes for built-in mechanical air cleaning and air-mixing boxes for controlled mixing of fresh and recirculated air.

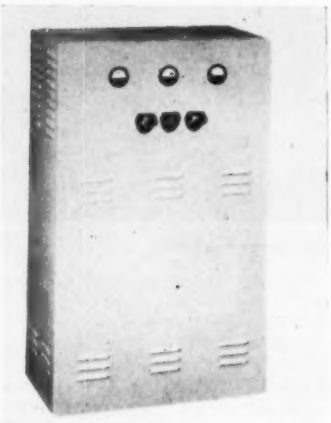
Westinghouse Electrical Corp., Sturtevant Division, 200 Readville St., Hyde Park, Boston 36, Mass.



Timers (23)

Three new series of timers, the CR3MB-KT2 timers, and the JW series. The CR3MB-KT2 is a dual-range cycle repeater unit which consists of two electrically interlocked timers. One timer regulates the frequency of operations of the second timer. The second timer regulates the duration of circuit "ON" time. The timer regulating the frequency is provided with a removable, pin-type dial which assures accuracy in setting, while the dial of the duration timer is of the fan type for adjustability. These timers are used in boiler water-feed and chemical-feed pumping, sampling procedures, sewage-disposal scarifiers, central lubricating systems, etc. The JW series timers are small, percentage type, cycle repeaters designed for permanent mounting. They provide a range of adjustability from zero to 90% of the dial. The JW timers are used in "hold-fire" furnace applications, for control of ventilating fans, battery charging, and many other applications.

Paragon Electric Company, Two Rivers, Wis.



Power System (24)

A new line of automatic emergency power systems using nickel cadmium batteries for emergency operation of lights, fire alarms and public address systems. Known as Light Warden, it features automatic charging. Some of the advantages are long battery life; lower maintenance; cannot be overcharged; cannot deteriorate; resistance against shock or vibration; immune to lowest temperatures; no sulphating or similar disintegrating process; no generating corrosive or poisonous process; immune to occasional excessive discharge and short circuits. It will be available in 6, 12, 24, 32 and 110 volts with ampere capacity to meet specific requirements. Cabinet size is 42 inches high, 26 inches wide and 14 inches deep.

Electric Cord Company, 195 William St., New York 38, N. Y.

Insulation (25)

Two new lightweight Hi-temperature insulations that meet all Class "H" requirements. Sil-Thin-Glas .022 and .033 and Sil-Thin-Bestos .003 to .0035 possess exceptional dielectric and tensile strength. Their thinness, flexibility and lightweight permits compact construction. Available in rolls, sheet or tape form, they are especially recommended for coil and relay insulation, layer and barrier insulation for transformers, and coil wrappings for fields and stators.

Electro-Technical Products, Nutley 10, N. J.

Follow the Circle..

You can trust it...

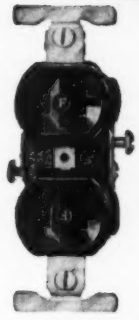
These Circle F wiring devices meet all federal specifications, and all requirements of the REA and CSA. They have earned approval of the Underwriters Laboratories.

You can sell it...

Circle F means wiring devices manufactured from the best grade of materials—by skilled labor—and thoroughly tested and inspected. You know you're selling the best when you sell Circle F.

No. 2035
If you want a small, compact switch that really stands up, get this all bakelite, Flush Toggle Switch with box screws mounted in ears. Single pole, brown or ivory. Easy to install. Wide ears are scored. 5A-250V—10A-125V. [T]

No. 9101
Perfect if you want a Flush Toggle Switch for extra rugged use. All bakelite—totally enclosed—top wired—has positive kick off. Brown or ivory. Also in three way. 5A 250V—10A-125V [T].



No. 109
Ideal if you want a flush duplex, T-slot receptacle with plaster ears that is quickly installed. Box screws mounted in ears. All bakelite body in brown or ivory. 10A-250V—15A-125V.

No. 136
You'll find this Duplex Flush Receptacle easier to install because box screws are mounted in ears—binding screws are backed out. Wide ears are scored. All bakelite—brown or ivory—double contacts. 10A-250V—15A-125V.

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GUARANTEED F WIRING DEVICES

Finest Hi-Hats on the market... yet competitively priced!

WHEN YOU'RE PLANNING new recessed lighting, be sure to see Amplex Hi-Hats. Just put one of these lighting units alongside any other and you'll insist on Amplex. It's the best looking fixture on the market...looks best because it *is* best, in design, construction and finish.

Amplex Hi-Hat has a permanent deluxe satin aluminum finish, inside and out... a rolled flanged edge for extra strength and better ceiling fit. The can is deep-drawn to provide uniform thickness and a smooth surface... plaster ring is keyed for perfect aligning... improved louver is more efficient; won't drop out. And on top of all this, Amplex Hi-Hats are today's best dollar value.

Amplex Hi-Hats, Swivelites and Focalites give you an accent lighting line that meets every display requirement and saves real money. Write for the full story about today's fastest-growing line. **Amplex Corporation, Dept. C-3, 111 Water St., Brooklyn 1, N. Y.**

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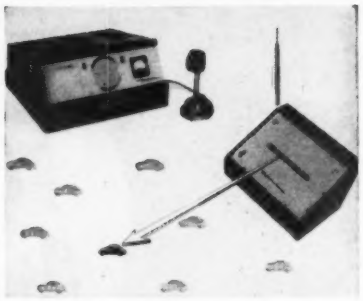
Sealed-Beam Reflector Lamps, Colorbeam Lamps, Spotlites and Floodlites, Industrial Infra-Red Heat Lamps, Vibration and Rough Service Lamps, Street Lighting Lamps, Traffic Signal Lamps, Incandescent Lamps, Fluorescent Tubes, Display Accessories.



Signaling System (26)

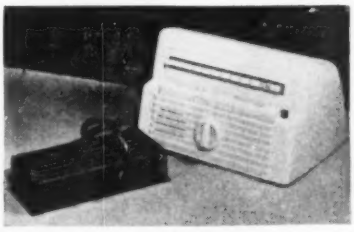
A single tone selective signaling system for applications in industrial, public safety, transportation, and utility communications systems. It has been designed for use in conjunction with any communication medium—two-way radio, land lines, microwave or power line carrier, anywhere that remote control or receiver selection is a necessity. The function of the system is to allow any operator to inititate an operation at one or more remote points through an intervening communication medium. There are four basic components to the single tone system: the 10-button selector box, the single tone oscillator, the three frequency switch kit, and the single tone decoder.

Motorola, Inc., 4545 Augusta Blvd., Chicago 51, Ill.

Toggle Switch (27)

A new toggle switch with plaster ears for residential use. Rated at 10 amp, 125 volt; 5 amp, 250 volt, this single pole toggle switch, Cat. No. 784, is available in brown or ivory toggles. Listed by Underwriters' Laboratories and C.S.A. "On" and "Off" is marked on brown toggle in white, and on white toggle in black. To provide quick and easy installation, switch has exceptionally wide plaster ears, and large head 5/32-in. wire screws that are staked and backed out.

Eagle Electric Mfg. Co., Inc., Long Island City 1, N. Y.

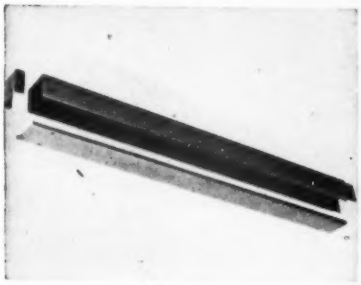


Intercommunication Unit (28)

A new 20-watt Redi-Power Talk-A-Phone, featuring a baseboard mounted power supply enabling the unit to deliver up to twice the maximum output of its

10-watt counterpart. It is self-compensating to deliver required power to all or a select group of stations, supplying power to each station when called simultaneously as well as individually. Power supply eliminates need for separate booster or paging system, and it is housed in a small crackle-finished louvred unit installed out of sight but available for ready use. Unit features Multi-Magic selector; dynasonic universal feature; hold-a-matic conference control; Uni-trans dictation control and other exclusive features of the new "Chief" series. A safety fuse is incorporated. Twelve, 20, 30 or 40 station capacity can be housed in same cabinet with 12 push-buttons, while with the Dynasonic universal feature the system can be expanded or changed at any time to handle new situations or requirements without discarding original equipment.

Talk-A-Phone Co., 1512 So. Pulaski Rd., Chicago, Ill.



Wireway (29)

A new wireway designed for use with meter boards, service boards, loadside switches, etc. These flangeless screw cover wireways are 2½-in. square, available in 1, 2, 3, 4 and 5 foot lengths. Conveniently spaced knockouts for ½-in. and ¾-in. conduit are provided. Wireways are made of heavy code gauge steel, finished in gray baked enamel. Auxiliary fittings include closing plates and "U" connectors.

Keystone Manufacturing Co., 23328 Sherwood Ave., Center Line, Mich.

Silicone Varnish (30)

Silicone Varnish 994 is a heat resistant electrical insulating varnish. It is used primarily for coating glass cloth and sleeving and for bonding mica-glass combinations. It is fast curing. In most applications, a cure of one hour at 250 C produces a flexible film that is heat stable and water repellent. Initial dielectric strength is in the range of 1600-1900 volts per mil, but 65% of this strength is still retained after 2000 hours at 250 C. Tests made according to ASTM D115 indicate that the craze life of Varnish 994 is in the range of 3000 hours at 250 C and 800 hours at 300 C. Flex life under the same conditions is in the range of 1000 hours.

Dow Corning Corporation, Midland, Mich.

"Blackhawk BENDERS are just plain handier and really portable"

ROLL OR CARRY EASILY TO JOB

WORK AT ALL ANGLES

BEND ON THE BENCH OR OVERHEAD

SPOT FROM ANY ANGLE

WRITE FOR THIS HELPFUL—CATALOG 50B. It fully describes Blackhawk Hydraulic Benders and 60% faster Knockout Punch Drivers.

More speed-minded contractors and crews are changing over to Blackhawk

COMPARE *all* pipe benders and you'll discover Blackhawk gives you a spectacular edge in speed and ease of workmanship!

Big difference is the design of the hydraulic unit. With Blackhawk's "Porto-Power" Bender you can pump from *any spot* because the hydraulic pump is *separated* from bender by a flexible safety hose. Bender works in any position — on its side or upright . . . on table or floor . . . on existing runs. A man can move around, "jockey" the pipe with one hand — sight along it if necessary . . . without stopping the pumping. What's more, there's a Blackhawk Bender for every popular size of conduit — rigid and thin-wall. Remember, too, the "Porto-Power" hydraulic jack can also be used to lift machinery, pull pulleys, lick dozens of allied jobs.

On job after job, crews who have a choice of benders prefer Blackhawk. They know Blackhawk works better, faster. And that means more profits. Get your "Porto-Power" Bender and other Blackhawk Electrician's Equipment *NOW* from your Electrical Wholesaler or Industrial Supply Distributors.

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HYDRAULIC TOOLS • HAND TOOLS

CLIP AND MAIL COUPON TODAY

BLACKHAWK MFG. CO.,
Dept. P-2033, Milwaukee 1, Wisconsin

Rush free Catalog 50B on Blackhawk's Electrician's Equipment

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New!

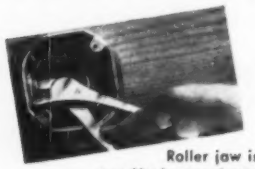
ANGLE LOCKNUT PLIERS

BY

UTICA®

No. 750-8"

- tightens locknuts in outlet boxes
- removes burrs from conduit or pipe
- cuts and skins rubber-covered wire



1 TO TIGHTEN LOCKNUT

Roller jaw is placed in center of locknut and rotates freely. Fixed jaw twists and tightens by catching locknut lugs.

2 TO CUT AND STRIP INSULATED WIRE

Wire is cut by placing in base of jaw. Insulation is stripped by crushing between roller and tip of jaw where spacing is designed for No. 14 to No. 8 wire.

3 TO REMOVE BURRS FROM OUTSIDE OF CONDUIT

Roller jaw is placed inside pipe. Scraping edge catches burrs on the outside.

TO REMOVE BURRS FROM INSIDE OF CONDUIT

Roller jaw is placed on outside of pipe. Scraping edge works on inside.

Your tool dealer has the new UTICA Angle Locknut Pliers or can get it for you.

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DROP FORGE AND TOOL CORPORATION

UTICA 4 NEW YORK

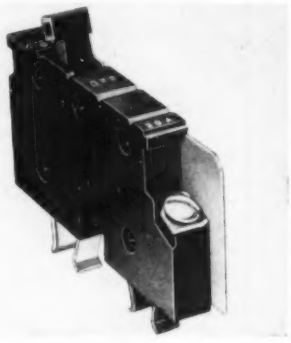
IT PAYS TO BUY QUALITY TOOLS

and the world's best tools are made in U.S.A.

Conduit (31)

"Sealtite" flexible electrical conduit Type UA has Underwriters' Laboratories approval for use in wet locations. The tough, extruded synthetic covering over Type UA's flexible metal core protects wiring against moisture, oil, dirt, chemicals and corrosive fumes—on permanent and temporary installations. Conduit is made of spirally wound, interlocked zinc-plated steel strip with a copper bonding conductor wound spirally in the space between each convolution on inside of conduit. Type UA can be cut to required lengths. It is for use both indoors and outdoors. Available in long lengths in nominal electrical ID sizes ⅜-in. to 1¼-in. inclusive.

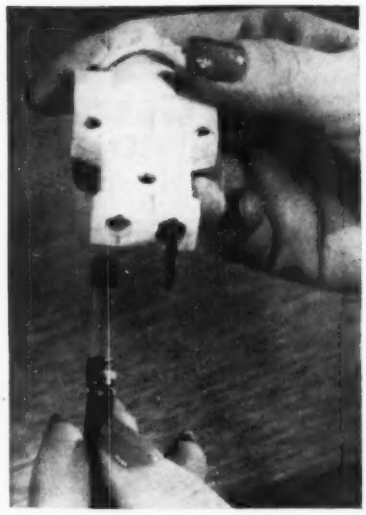
American Brass Co., Waterbury, Conn.



Circuit Breaker (32)

A new XO circuit breaker for lighting and general purpose loads. Operating features include: quick-make, quick-break operating mechanism; positive operation; automatic relatching; ambient compensation; plug-in mounting; shock resistance and thermal-magnetic protection for both moderate and heavy overloads. 15 and 20 amp. single pole breakers are ½-wide while 30, 40 and 50 amp ratings are ¾-in. wide per pole and available in double pole construction. It is impossible to interchange larger capacity breakers with smaller rated units. The XO load center line, covering a range of from 1 to 32 circuits, is made up of six basic boxes. Single phase—3 wire, three phase—4 wire, main lugs and main breakers, and general purpose or raintight enclosures are available.

Square D Company, 6060 Rivard Street, Detroit 11, Mich.



Electric Plug (33)

Hazards of overloaded and shorted electrical circuits can be reduced by a new type of electric plug which contains two easily replaceable safety fuses. The small fuses "blow" when the plug's wire is shorted or overloaded, leaving rest of circuit undisturbed. An electric appliance can be wired to plug by inserting the wire (rubberized, double strand) in it and turning a locking spring. One 250-volt glass cartridge fuse is attached to each prong and is removed by pressing prong into plug and twisting. Available in ivory or brown.

Noma Electric Corporation, 55 West 13th Street New York 11, N. Y.

Generators (34)

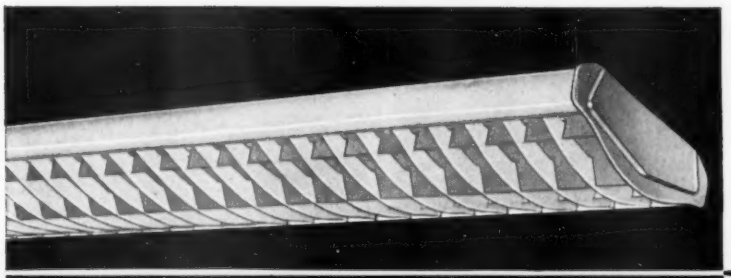
A new generator that can be geared and controlled not only to meet widely varying steam requirements, but differential shifts in the individual user's needs within the working day itself. Known as the "Hotshot Tandem" generator, it is an integrated combination of miniature electric boilers. Each component unit is itself a separate generator that can be "unlocked" and made to operate independently by the turn of an electric switch. When all the components are added and operating simultaneously, it can build up to ten boiler horsepower; in a few moments the same machine can be stepped down to as low as one-third horsepower. Complete tandems available with maximum ratings below 10 B.H.P. Available in 18, 24, 30 and 36 kilowatt sizes; voltage 220, 3 phase.

Automatic Steam Products Corp., 140 W. 31st Street, New York 1, N. Y.

new mitchell fluorescent luminaires

with upward component and low cost efficiency

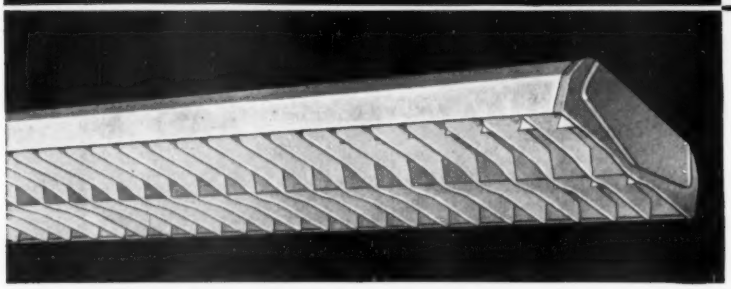
MITCHELL engineering achieves remarkable standards of abundant, glare-free illumination in these new Commercial Luminaires. Important lighting advantages are achieved by the substantial upward component which provides a "general diffuse" lighting effect. The superior louver design delivers properly shielded illumination to the working area. Smooth styling, unusually low maintenance factor and surprisingly low cost make these new MITCHELL Luminaires outstanding values in commercial fluorescent lighting.



the "LODESTAR" luminaires
with translucent plastic sides

4-FOOT MODELS: Available in 2 or 4 lamp luminaires, choice of 40-watt medium bi-pin, 40-watt Instant-Start, 40-watt Rapid-Start, 38-watt Slimline.

8-FOOT MODELS: Available in 2 lamp 75-watt Slimline; 4 lamp or 8 lamp 75-watt Slimline, 40-watt medium bi-pin, 40-watt Instant-Start, 40-watt Rapid-Start or 38-watt Slimline.

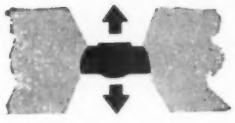


the "ECONOMY" luminaires
with metal sides

4-FOOT MODELS: Available in 2 or 4 lamp luminaires, choice of 40-watt medium bi-pin, 40-watt Instant-Start, 40-watt Rapid-Start, 38-watt Slimline.

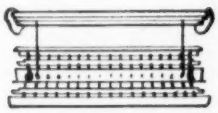
8-FOOT MODELS: Available in 2 lamp 75-watt Slimline; 4 lamp or 8 lamp 75-watt Slimline, 40-watt medium bi-pin, 40-watt Instant-Start, 40-watt Rapid-Start or 38-watt Slimline.

outstanding lighting features and maintenance advantages



These luminaires are of the "General Diffuse" type; approximately half the light goes up to be reflected from ceiling and upper walls to provide comfortable, glare-free, uniform lighting.

New Rapid-Start units offer an unusual advantage: "No starters to replace." Installation of Rapid-Start luminaires slashes maintenance cost by eliminating starter replacement expense.



Two jack chains suspend entire louver and V-spine assembly from fixture body, making relamping easy and substantially reducing maintenance costs. This convenience feature saves time and money.

Sturdy, concealed spring-loaded louver latch instantly releases or engages all-steel louver by snap-in action. Releases with slight pressure of fingers. Simplifies relamping and maintenance.

where quality counts—
SPECIFY MITCHELL

The superbly engineered MITCHELL "Lodestar" and "Economy" luminaires are built to the most exacting standards for easy time-saving installation, for low-cost maintenance, for dependable long-life performance. Where *quality* with sensible initial cost are important considerations—be *sure*—specify MITCHELL. For complete specifications covering these new luminaires, ask for Bulletins 707 and 708.

MITCHELL MANUFACTURING COMPANY
2525 N. Clybourn Ave., Chicago 14, Illinois
In Canada: Mitchell Mfg. Co., Ltd., 19 Waterman Ave., Toronto

MITCHELL

Mitchell Manufacturing Company, Dept. 2-C
2525 N. Clybourn Ave., Chicago 14, Illinois

Send full data on MITCHELL "Lodestar" and "Economy" Luminaires.

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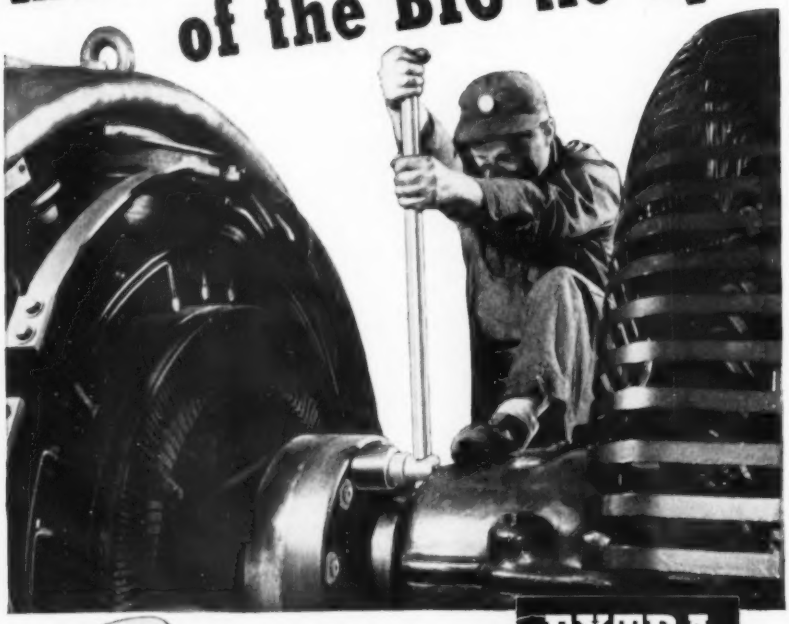
make FAST work of the BIG tie-ups!

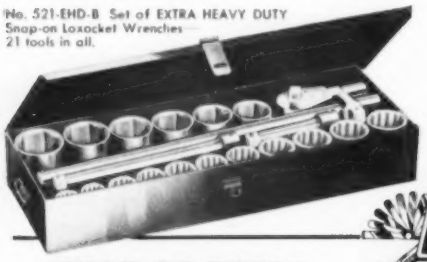


Snap-on* EXTRA HEAVY DUTY LOXOCKET WRENCHES

● Because most machine maintenance jobs begin and end with wrench work, *the better your wrenches the faster, surer, safer the job.* Above is a perfect example—no room for a ratchet head or an open-end. But a Snap-on Extra Heavy-Duty Sliding Bar and proper socket gives a man a sure grip and sweeping power.

The full Standard Set of these powerful tools, pictured below, will give your crew the *right* equipment to break loose those big, rusted-on nuts and bolts, or to tighten them up to the limit . . . with no time-wasting makeshifts. There are many more shop-proved Snap-on tools that will save money in your plant—more than 4,000 to meet the widest range of needs. Snap-on gives you close-at-hand service through factory branch warehouses in principal industrial centers. Write for the Snap-on Special Industrial Catalog and 104-page General Catalog.

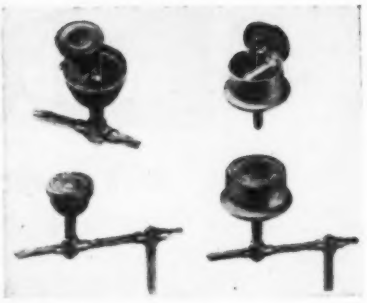
No. 521-EHD-B Set of EXTRA HEAVY DUTY Snap-on Loxocket Wrenches 21 tools in all.



SNAP-ON TOOLS CORPORATION

8048-C 28th Avenue, Kenosha, Wisconsin

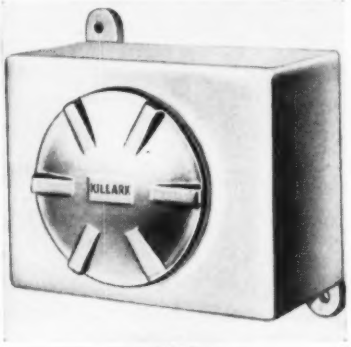
*Snap-on is the trademark of Snap-on Tools Corporation.

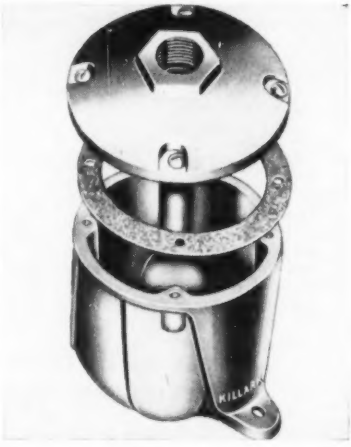


Grounding System (35)

A permanent grounding unit designed for aircraft requirements such as refueling has been added to this line. Type S-389 is used only for grounding, while Type M-1367 is a combination tie-down and grounding receptacle. The receptacle studs fit the standard ¾-inch ground rod welder. The connections are permanent, cannot loosen or corrode and require no maintenance.

Erico Products, Inc., 2070 East 61st Place, Cleveland 3, Ohio.



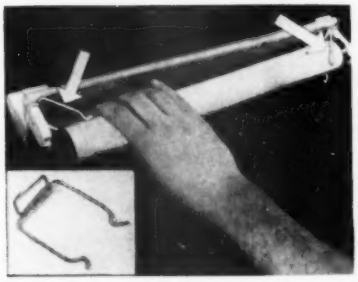


Electrical Fittings (34)

Two new electrical fittings have been added to this line. One is a large-size explosion-proof junction box, identified as "Type GRJ", measuring 10-in. by 9 x 8-in. by 5¼-in. Features and installation advantages are: exclusive Alumalloy used in construction. Alumalloy is rust-proof and corrosion-proof. The "GRJ"

will take conduit up to and including 3-inch sizes. It can be supplied with hubs in any location. Large, open-cover design permits easy installation, quick, convenient splicing. The other item is the "Series VLJ" vapor-tight box. All members of this series are four inches in diameter, with models from 1⅝ inches to 3½ inches deep. They can be furnished with a blank or hub cover, or can be supplied with an adapter plate designed to take Killark vapor-proof lights or any outlet box device for 3¾-in. or 4-in. outlet box. Vapor-proof boxes are designed from Alumalloy and will take up to 1-inch conduit sizes.

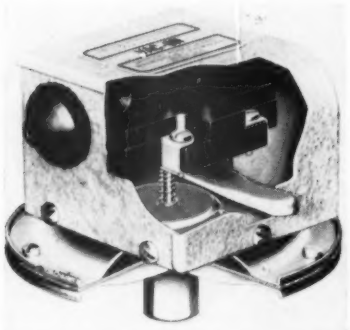
Killark Electric Manufacturing Co., Vandeventer and Easton Aves., St. Louis 13, Mo.



Guards for Fluorescent Lamps (37)

Slip-on guards that prevent fluorescent lamps from falling from sockets, despite heavy vibration or spreading of fixtures. Called the Gets-A-Lite guard and guide, this device is constructed of spring wire, and formed into the shape of a "U", with the sides 2¼ inches long, terminating into outward-pointing prongs, the other end containing a small rectangle set at right angle. In use, the guards are slipped over the sockets at each end of the fixture and left there. It serves as a guide in addition to being a guard, steering the lamp into its socket.

The Gets-A-Lite Company, 3865 N. Milwaukee Ave., Chicago 41, Ill.



Vacuum Switch (38)

A new vacuum switch that shuts off power source when liquid supply runs dry. Designed for use with electric motors and gasoline engines, the "Vac-on" switch has

GE WATER COOLERS

NOW, BID COMPETITIVELY ON WATER COOLERS for new construction, expansion and modernization work – and be sure you're offering the finest line available! General Electric's new Water Cooler Plan enables you to handle the well-known G-E line under appointment by your G-E wholesaler.

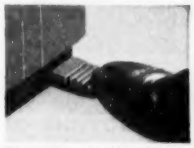
NO STOCKING—QUICK DELIVERY! Your G-E wholesaler maintains complete stocks of G-E Water Coolers and arranges delivery to suit you. And, if you wish, he will service all units installed within reasonable distance of his headquarters.

5-YEAR PROTECTION PLAN! Every G-E Water Cooler is backed by G-E's generous 5-year protection plan. "Over-the-counter" replacement by your G-E wholesaler simplifies your operation.

POWERFUL SALES AID! G-E's scientific "Work Center Plan" helps you sell more units by showing your customers how to place them for greatest employee efficiency.

Why not get all the facts now? Send coupon, or contact your nearest G-E wholesaler. He's listed in your phone book under "Water Coolers."

SANITARY STAINLESS STEEL TOP. No seams or crevices to harbor dirt and germs. • No squirt, no splash, no spill.



OPERATES AT TOE-TOUCH. Even with arms full, you get a cool, satisfying drink. Dirty hands need never touch unit.

You can put your confidence in—

GENERAL ELECTRIC

FREE! New G-E study, "Where to Look for VALUE in a Water Cooler!"

General Electric Company, Section EC-5
Air Conditioning Division, Bloomfield, New Jersey

☐ Tell me more about the new G-E Water Cooler Plan.
☐ Please send free literature.

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MARTINDALE

GROWLERS

PORTABLE GROWLER TYPE U-2

This Universal Adjustable Growler may be used as both an external Growler for armatures and an internal Growler for stators. It will test armatures from 2" diameter up, and stators from 5¾" diameter up.

ADJUSTABLE BENCH GROWLER

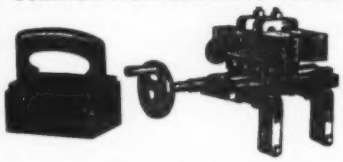
Has adjustable jaws with face length of 2½". With jaws closed will test armatures as small as 1" diameter. With jaws open, will accommodate armatures as large as 18" diameter.

Both types available with or without meters. Also six other models.

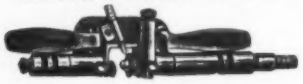
MARTINDALE WHEEL AND GEAR PULLER

Adjustable arms pull straight without squeezing the work. Set screws prevent spreading. Made in 2 Styles and 4 Sizes up to 24" diameter.

MARTINDALE COMMSTONES AND COMMUTATOR GRINDING TOOLS



MICA UNDERCUTTERS FOR SLOTTING COMMUTATORS



Nine Motor Driven Types

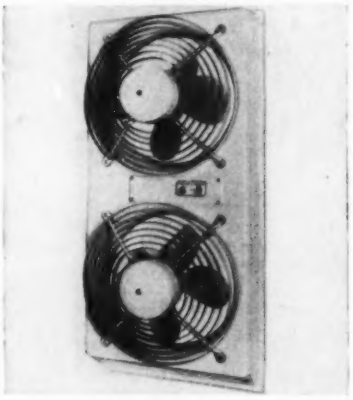
Write for 64-page Catalog describing these and many other products for Industrial Maintenance, Safety and Production

MARTINDALE ELECTRIC CO.

1309 Hird Ave. Cleveland 7, Ohio

many industrial, marine and manufacturing applications as a circuit breaker or control where safety of equipment depends on a suction-delivered lubricant, fuel, water or similar liquid. It also serves as a warning control where operating conditions depend on a vacuum. Switch mounts on suction line and is wired into power supply on electric motors, or spark system on gasoline engines. When suction falls below a predetermined negative pressure, switch automatically cuts off motor. It operates on electric motors up to 2 hp on ac and ½ hp on dc. A hand lever is incorporated on switch for manual restart.

Jaycon Associates, 404 North Washington Ave., Minneapolis, Minn.



Casement Window Fan (39)

A new casement window fan, especially designed for modern homes. A panel makes it easy to install in any standard 3-light casement window, using only a screwdriver. An extra panel is furnished for standard 4-light casement windows. It can be mounted with or without a screw. Unit has two speeds, and features twin fans, 12 inches each in diameter, which can be reversed electrically for either day or night cooling. Capacities range from 1300 rpm and 1500 cfm at low speed, to 1550 rpm and 2000 cfm at high speed. Units are finished in silver gray. Other features include a spiral grille and a weatherproof motor housing.

Robbins & Myers, Inc., Memphis 2, Tenn.

Clothes Dryers (40)

Two new automatic clothes dryers. It is recommended that they be operated on 220 volt, three-wire service but can be wired for 110 volt operation. The timer controls are calibrated to a full cycle of 140 minutes. Two illuminated dials on the backsplasher of the custom dryer are color coded to permit determination of settings at a glance, and indicator light, centered between the dials, glows red during operation. A safety switch shuts off heating element and stops basket rotation when dryer door is opened. Custom dryer has ozone lamp. Custom model DA-620K costs $249.95 and Da-420K Deluxe costs $229.95.

General Electric Co., 310 W. Liberty St., Louisville 2, Kentucky.

Cooker and Fryer (41)

A new cooker and deep fat fryer featuring large capacity for any deep well cooking or frying operations. Fryer has a tapered-bowl design. Cooker can be used for table or buffet serving. It has a six-quart capacity. Automatic heat control dial has a temperature range of 150° to 425°. Rating is 1,450 watts. Price is $29.95.

Westinghouse Electric Corporation, Pittsburgh 30, Pa.

Product Briefs

(42) Holub Industries, Inc., Sycamore, Ill., has introduced a unique design in a new **masonry drill** which permits continuous drilling.

(43) Wall Manufacturing Company, Grove City, Pa., has introduced a new instant heat gun type of **soldering iron.** . . . (44) A new line of Ball-Rite **industrial drills** has been announced by Cummins-Chicago Corp., 4740 Ravenswood Ave., Chicago, Ill. . . . (45) A new "Spacer Type" **gear coupling** which can be disconnected without wrenches or special tools, has been introduced by the Sier-Bath Gear & Pump Co., Inc., 9252 Hudson Blvd., North Bergen, N. J.

(46) A new infrared **meter** designed to measure radiant-energy intensities up to 10 watts per square inch has been announced by the General Electric Co., Schenectady, N. Y. . . . (47) **Balancing ways** designed for static balancing of armatures, fans and other light work are being made by Crown Industrial Products Company, Woodstock, Ill.

(48) The Bristol Company, Waterbury, Conn., has announced the application of its Metameter **Telemeter** for use in taking remote readings of atmospheric temperatures in connection with weather observation. . . . (49) The Hilton Manufacturing Co., 1230 West Lisbon Ave., Milwaukee 16, Wis., has announced the production of a new aluminum **ladder**. . . . (50) A new all-purpose **mechanical seal** for rotary shaft applications has been introduced by the Crane Packing Company, 1800 Cuyler Ave., Chicago 13, Ill.

(51) Hospo Organization, Inc., 1850 W. Washington Blvd., Chicago 12, Ill., has developed a new line of **utility lights** for home, workshop, garage or portable light. . . . (52) Sierra Electric and Mfg. Co., 544 East 31st St., Los Angeles 11, Calif., has introduced **jumbo-plates,** to cover up damage to wall surface adjacent to box. . . . (53) Wall Manufacturing Company, Grove City, Pa., has introduced a new line of industrial electric **soldering irons.**

(54) A new Thor ¾-in. copper line **electric drill,** has been announced by the Independent Pneumatic Tool Co., Aurora, Ill.

You get ALL these Features when you buy PET Drills!

Reserve Power—for the extra-tough job. Powerful, Continuous-Duty Motors—built in PET's own factory. Dynamically Balanced Armatures—for freedom from vibration.
Six Heavy-Duty Ball and Needle Bearings.
Compact Design—makes hard-to-reach drilling jobs easier and faster.
Aluminum-Alloy Die Castings—for light weight, easy handling.
Forced-Ventilation—for cool running.
Precision-Cut, Heat-Treated Gears—for smooth, quiet power flow.

If you want the *best* for your maintenance or production work, take an extra look at the PET Superduty Drill shown here. Check its features! Here's a drill that's made for heavy, continuous duty...with *plus* power per pound . . . built to *work* right and *handle* right on the job.

Normally you might expect to pay extra for such features—in the form of "optionals" that jack up your cost. But that's not true of PET Drills! All these features are standard in the PET Superduty line . . . *and they're available to you at a standard drill price!* That's why the coupon below can save money for you. For free catalog and name of your nearest PET distributor, *mail it today!*

NOW...you can get the RIGHT DRILL for YOUR job!

PET Superduty Drills are available in 54 distinct models and 3 capacities: ¼", ⅜" and ½". Your choice of pistol or saw-type grip. With such a broad line, you don't have to compromise on a drill that's "almost" right! You can choose *exactly* the drill you need for your job. The PET Superduty line includes drills meeting U. S. Government and military specifications.

PET® POWER TOOLS

Plus Power per Pound

PORTABLE ELECTRIC TOOLS, INC.

320 West 83rd Street, Chicago 20, Illinois

In Canada: Portable Electric Tools, Ltd., 452 Birchmount Road, Toronto 13, Ontario, Canada

MAIL COUPON FOR FULL INFORMATION

PORTABLE ELECTRIC TOOLS, INC. EC-33
320 W. 83rd St., Chicago 20, Ill.

Gentlemen: Please send us free copy of your PET Superduty catalog, and name of nearest distributor.

*Name*_____ *Title*_____

*Company*_____

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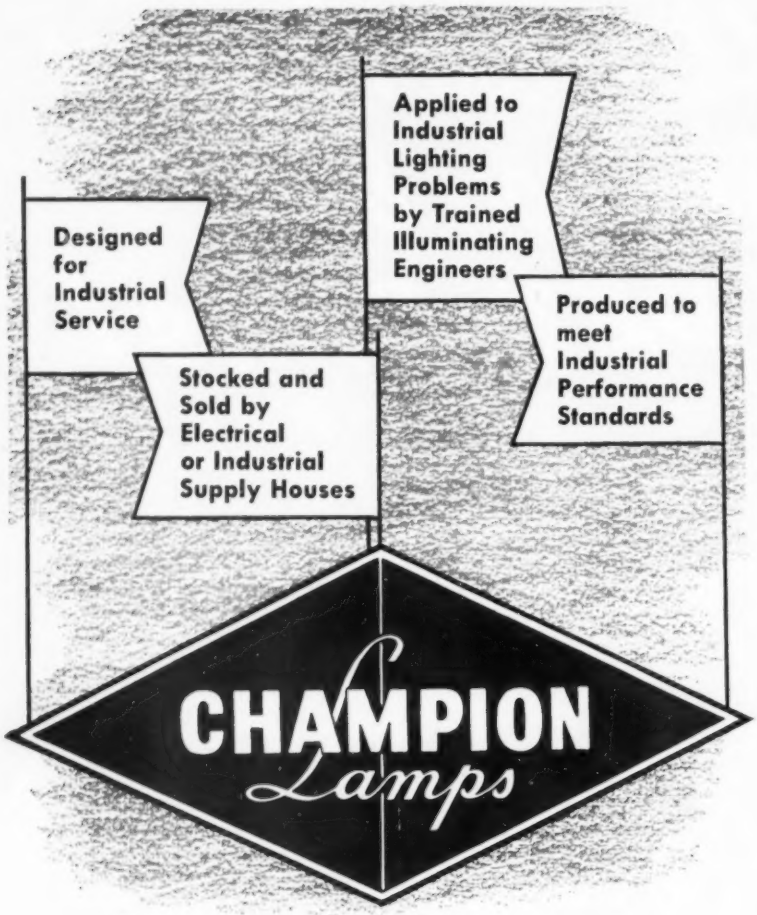
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(57) MOTOR CONTROLS are described and illustrated in 28-page bulletin, including controls, starters and accessories, with construction details and specifications on the units. Allen-Bradley Company.

(58) FLUORESCENT LUMINARIES for commercial and industrial applications are illustrated and described in 24-page pocket catalog, with construction and application information. Westinghouse Electric Corp.

(59) PLANNING MANUAL for the modern electrical home contains 20-pages of step-by-step instructions on planning kitchens and laundries, home lighting, adequate wiring systems, layout of wiring devices and selection of service entrance. Westinghouse Electric Corp.

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(74) GUIDE BOOK for plant engineers on electric power distribution practices in large and small plants contains 28-pages of illustrated data, including choice of primary voltage, applications of various equipment, grounding, calculations and allied subjects. General Electric Company.

(75) FUSE CATALOG contains 26-pages of illustrated data on all types of fuses, with sections covering features of fuses, technical data and a listing of fuses with specifications. General Electric Co.

(76) CONTROL CENTERS, multi-unit, are illustrated and described in 28-page bulletin, including construction, ratings, applications, layout charts, floor arrangements and typical specifications for selection. Allen-Bradley Co.

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(78) CIRCUIT BREAKER, magnetic air, for installation in vertical lift switchgear rated 4.16 kv, is illustrated and described in 4-page bulletin, including construction, operation and installation. Allis-Chalmers Company.

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LOW VOLTAGE CIRCUIT BREAKERS

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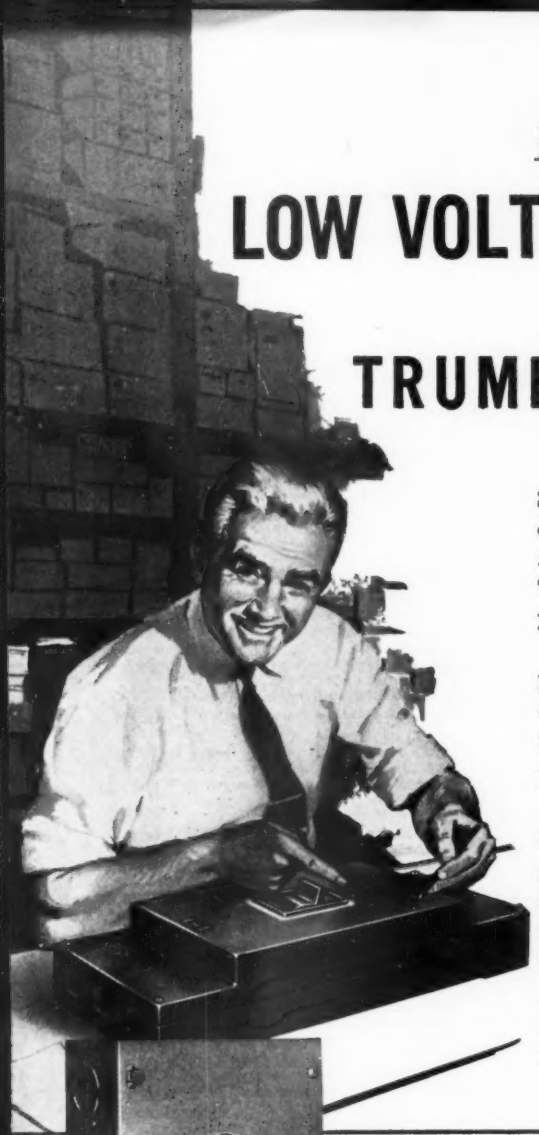

Superior design and construction features enabled Trumbull to develop circuit breakers that withstand the moisture, high-shock, and vibration of shipboard service required by the U. S. Navy. These same basic features enable your Trumbull Distributor to meet your *specific* needs from Trumbull's *complete* line.

Trumbull Circuit Breakers for load centers, panelboards, switchboards, for industrial, commercial and residential applications, provide greater safety to operators, better circuit protection against both shorts and sustained overloads. They pay off in convenience, permanence and fast restoration of service.

Available in ratings from 10 to 600 amperes and voltages up to 600 volt AC, 250 volt DC, either open type or with surface or flush-mounted enclosures, of semi-dust-tight, water- and dust-tight design. Accessories available for conversion to non-automatic, remote tripping, bell alarm and other special requirements.

Trumbull Circuit Breakers and breaker-equipped load centers, panelboards and switchboards, plus the advice of qualified Trumbull sales engineers, are available through leading Distributors everywhere. Write direct for literature or technical information.

Trumbull AT enclosed circuit breakers feature "trigger" trip, automatic tripping, silver-alloy contacts, individual calibration. 2- and 3-pole construction, from 15 to 600 amperes, 125 to 600 volt AC or 125 to 250 volt DC. Single pole available in 50-ampere frame size breakers, 125 volt AC or DC.

Trumbull TQL (plug-in) and TQ Circuit Breakers feature *both* thermal and magnetic protection, "trigger-type" quick-make and break, trip-free operation, trip-indicating handle, silver-plated contacts, arc-quenching chamber. Individually calibrated and sealed in compact, dead front phenolic cases. Ratings: 10 to 50 amperes, 120 volt AC, single pole.

TYPE TQL *TYPE TQ*

Trumbull K-173 Marine Hi-Shock Circuit Breakers, 3-pole, 125 volt AC or DC, 50 ampere frame size. Suitable for protection of lighting mains, feeder circuits, single load circuits supplying motors, radar, sonar, etc.

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Check these G-E Wiring Bulletins

For your free copies of these important G-E publications, MAIL COUPON NOW. Just jot down the numbers you want, and fill out the coupon.

(1) How to Lay Out and Estimate G-E Fiberduct Raceways #18-120UF — an informative article that covers planning phases of G-E Fiberduct installations. Included are specifications, symbols, and grid systems commonly used.

(2) Interlocked Armor Cable Booklet #19-211—new 20-page booklet consolidates system's component parts, cable, fittings, and racks—all under one cover. Tells why, where, and how to use this system designed for voltages up to 15 kv.

(3) Super Coronol*-Geoprene Power Cable Booklet #19-342 — 16 pages of test data, specifications, and splicing and terminating instructions.

(4) Geotrol Wire Flyer #19-410—describes use, explains advantages of this gasoline- and oil-resistant wire.

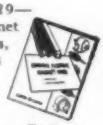
(5) Flamenol* Wire and Cable Booklet #19-191—12-pages covering development, types and uses of G-E Flamenol cables. Tables list selection data and properties.

(6) Switch and Outlet Box Chart #18-81-1—describes General Electric switch, utility and outlet box line in chart-form. Shows correct number of conductors permitted in G-E switch, utility, and outlet boxes. Ideal for quick reference by electricians, contractors, inspectors and maintenance men.

(7) Remote-Control Installation Guide #16-370 — Folder serves as guide for preparing specifications for installation of G-E remote-control wiring system and electrical wiring.

(8) Flexible Conduit Broadside #18-238—covers in general the wide variety of flexible steel conduit applications.

(9) Magnet Wire Booklet #19-329—32-page booklet details G-E magnet wire data. Specifications, properties, uses and advantages of various types are among subjects thoroughly covered.



(10) Grounding Outlets and Plugs Bulletin #16-801—contains complete product and catalog information on specially designed G-E grounding outlets and plugs.

(11) Levelock Switch Box Folder #18-100—illustrates 5 new Levelock features designed to solve common switchbox installation problems.

(12) How to Estimate for G-E Fiberduct Underfloor Wiring, #18-141UF — comprehensive folder that describes the easy method of estimating materials, labor units, and costs for G-E Fiberduct wiring systems.

(13) Copper Weight Chart #19-132—Single sheet showing weight of bare copper conductors in various types and sizes of wires and cables.

(14) Rigid Conduit Installation Hints Broadside #18-90 — twenty illustrated tips on installing rigid conduit.

(15) Selection of Proper Cable Sizes Booklet #19-269—dimension, voltage drop, and current-capacity charts make this booklet a handy reference for many power cable selection problems.

(16) Watch Dog* Starter Folder #16-309-6 — lists Watch Dog "no-blink" fluorescent starter types and sizes, explains Watch Dog advantages.

(17) How to Wire and Estimate Q-Floors #18-90-2 UF—concise folder gives estimating and installation advice for Q-Floor raceway layouts. Complete with drawings and jobsite photographs.

(18) Magnet Wire Bulletin #19-100—nutshell summation of G-E Formex* and Deltabeston* magnet wires.

(19) How to Install G-E Fiberduct, #18-151UF — Concise folder explaining recommended methods for installing G-E Fiberduct raceway systems.

(20) Your Stake in Q-Floor Wiring #18-110UF—a well-illustrated booklet that asks and answers, in simple and interesting terms, questions you may have about G-E Q-Floor raceway systems.

(21) Deltabeston Power Cable Folder #20-77—charts and tables give basic data on heat-beating General Electric Deltabeston cables.

(22) Mercury Switch Leaflet #16-379-2—Attractive four-page leaflet which describes the silent mercury switch. Available in quantity for distribution to your customers.

(23) Versatol*-Geoprene Power and Control Cable Booklet #19-390—12 pages give complete information and specification data.

(24) Flamenol Bus-drop Cable Folder #19-209 — covers installation information, specifications, and accessories for G-E bus-drop cables.

(25) Magnet Wire Booklet #20-147—attractively illustrated and easy to follow, booklet gives quick facts on Deltabeston magnet wire plus selection tables and specification data.

(26) Drive-in Theater Cable Bulletin #19-90-1—describes specific Versatol, Geoprene, and Flamenol cables developed for drive-in theater wiring circuits.

(27) Remote-Control Wiring Manual #16-200-3—comprehensive 36-page book covering all aspects of General Electric's remote-control wiring system. Includes suggested applications, advantages of remote control, description of components, circuit diagrams, specifications, and installation procedures.

(28) G-E Box Folder #18-112-1 — Valuable catalog information on the time-saving features of G-E boxes designed to meet a variety of wiring needs.

(29) Fuse Catalog #16-132—a comprehensive listing of all G-E fuses with features of renewable and one-time fuses.

(30) Save with Deltabeston Power Cable Folder #19-159 — features economies of Deltabeston installations.

(31) Remote-Control Wiring Booklet #16-330—informative publication for your customers. Also available in quantity upon request.

(32) Heating Cable Set Folder #16-742—shows the three main uses of these handy heating cable sets: roof de-icing, water pipe protection, and soil heating.

(33) Heating Cable for Industrial Pipe Heating, Folder #16-832 — installation instructions for use of G-E heating cable in industry to reduce the viscosity of oils, syrups and similar liquids to speed flow in pipes.

Section K3-318
Construction Materials Division
General Electric Company
Bridgeport 2, Connecticut

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GENERAL ELECTRIC

QUESTIONS from readers on problems of industrial equipment, installation, maintenance and repair. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published we pay $5.00.

Reader's Quiz

Correcting Power Factor

QUESTION N22—If it is known that the power factor of a manufacturing plant is poor what steps should be taken to correct the fault? The plant operates on 220 volt, three phase, 800 ampere service. Largest motors are 15 hp. What would be the type, size and location of capacitors to correct from 70% power factor?—G.J.

ANSWER TO N22—Not knowing the plant kw it is impossible to state what capacity is necessary to raise the power factor from 70% to a higher value. It is very easy to obtain from manufacturers of capacitors for power factor correction, a table of factors to use in figuring the necessary capacity to raise a Power Factor to any value up to 100%.

The procedure is to measure the total kw input and from the table select the factor to multiply by the kw input to raise the power factor from its original value to the value desired. One reason for power factor correction is to avoid a penalty for a power factor below 85%.

If capacitors are installed on the line near where they enter the plant to raise the total load power factor, to a high value, there is the possibility when only a few motors are operating, to produce a leading current resulting in lowering the power factor.

The most efficient method is to install a capacitor as near each motor as possible in which case the capacitor is automatically disconnected from the line when the motor is not running resulting in maintaining a good plant power factor.

The large motors, 10 or 15 hp, should have a power factor above 85%, but a one hp single phase motor has a power factor near 70%. Its input is approx. 1 kw. To raise the power factor of this motor from 70% to 90% you would multiply the 1 kw by the factor .536 resulting in .536 kvar capacitor required. This Factor (.536) can be used for any kw input to raise the Power Factor from 70% to 90%. —B.A.S.

ANSWER TO N22—I believe you will find that the information is very well covered in the book "Capacitors for Industry" by Bloomquist and Wilson, a John Wiley publication. If power-factor improvement is to be considered for the motors only, then the Tables 9.2 and 9.3 on pages 98 and 99 list the proper rating of capacitor for motors of various horsepower and speeds.—W.C.B.

ANSWER: The cheapest way to raise the power factor would be the installation of capacitors on the mains. Capacitors of the DTSR type 3 phase 60 cycle 230v. 180 kvar would be enough to correct the pf to 98.5%. If it is desirable to relieve the load on certain feeders the capacitors could be divided into smaller units and placed on the ends of the feeders. A third way would be to have capacitors at each motor, switched with the motor.

Unless there are only a few large induction motors this method would be more expensive. It is impossible to give a definite answer as to the best method without a graph of the load and a connection diagram.—J.B.P.G.

Locating Conduit

QUESTION P22—How can I locate conduit with or without an outlet box that was plastered or cemented in a wall or reinforcing ceiling?—H.S.

ANSWER TO P22—Conduit hidden in a wall can be located by a magnet or compass if the wall is not constructed of metal lath. Boxes plastered in have been located with a small magnet hanging on a string and carried along close to the wall at the approximate height.

Floor conduit can be located by using a surveyor's dip needle. It would also dip at any other metal in the floor.

A general idea can be arrived at by pushing a steel fish wire in the conduit, shaking it and listening for the sound. All in all it's not a simple task sometimes.—G.J.

ANSWER TO P22—There are instruments manufactured for the purpose of finding hidden conduits, but in most cases it can be done with a small compass. If there is a chance to run direct-current over the conduit, from end to end, the compass will show a definite deflection. An automobile storage battery would furnish plenty of amperage. Needle will tend to reverse direction as you pass the center of conduit, because the magnetic lines of force are in circles around the conduit.

In some cases the compass will show enough deflection near the conduit without passing any direct current, if you approach the wall from some other direction than geographical south. Then the pipe will tend to move the needle away from the magnetic south pole. (Which of course is near the geographical north pole).—M.C.T.

Resistance Type Welders

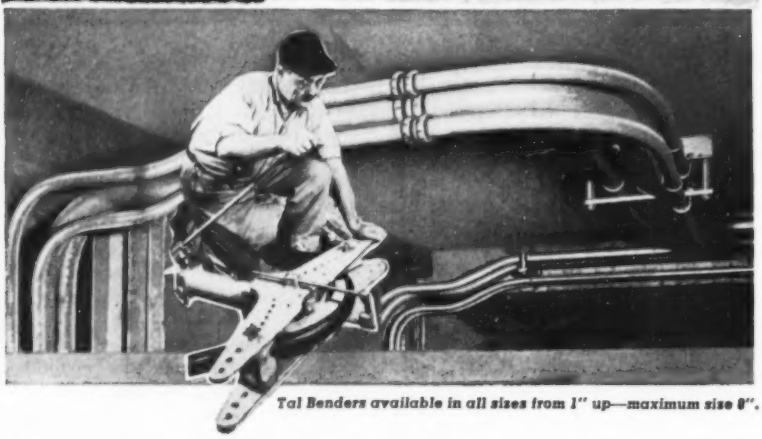
QUESTION Q22—We have several transformer type ac welders with 220 volt primary and approximately 40 volt secondary. There are no taps on either the primary or secondary. The secondary output is controlled by a reactor coil in series with the secondary—this reactor on one leg of a transformer type structure and two dc coils on the other leg, output varying according to the dc input. What is the principle of this control? How does it affect the wave form of the output?—S.R.U.

ANSWER TO Q22—The principal of this control is that the reactance of an iron core reactor varies with the amount of saturation of the core. The saturation is controlled by the dc current. Increasing the dc current increases the saturation and decreases the reactance. Decreasing the dc current decreases the saturation and increases the reactance. This is a common control in many types of equipment today. The wave form is not affected.—W.E.G.

ANSWER TO Q22—This type of control uses the saturable reactor principle and is used both for welding control and lamp dimming.

TAL PORTABLE BENDERS

BEND THINWALL or RIGID CONDUIT FASTER



Tal Benders available in all sizes from 1" up—maximum size 6".

You can earn bigger profits by reducing up to 80% the number of elbows and couplings otherwise needed. Save on cutting, threading and installing. This is possible with a Tal, because Tal Portable Benders make any degree bend in *one setting without shifting the conduit* . . . and do the job faster!

No guesswork for offsets, long sweeps or any other bends. No experience necessary to make accurate, wrinkle-free bends quickly, right on the job.

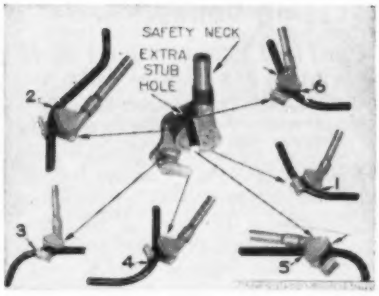
No spoilage. Bend indicator assures identical repeat bends without measuring.

Actual bending time of a 90° bend in 3" conduit with a motorized Tal Bender—1 minute, 51 seconds. Other sizes in proportion. Assembly time of a Tal Bender (2 parts only)—less than 1 minute.

Learn today how you can earn more money and handle more jobs with a Tal Portable Bender.

TAL 6-WAY HICKEY FOR RIGID CONDUIT

Exclusive design of the six non-slip bending jaws assures perfect elbows, offsets, loops, saddles, stubs and sets in close quarters or on open slab work. No effort, no kinks. The bending jaw grooves of this "Safety-First Hickey" are slip-proof, and long safety neck prevents it from breaking at the threads. Has extra stub hole for bending conduit protruding from concrete. *Guaranteed for life against breakage.*



Nos.	Size	Weight	Package Price of Ten	Unit Price
50	½"	3½ lbs.	$3.10 ea.	$3.70 ea.
75	¾"	5 lbs.	3.90 ea.	4.65 ea.
			Package Price of Three	
100	1"	8½ lbs.	6.65 ea.	7.95 ea.

COMPLETE LINE OF BENDERS
For rigid conduit up to 5 inch and small Combination Production Benders for Rigid and Thinwall Conduit, for ½" and ¾".

WRITE FOR THIS FREE BULLETIN

Tal Bender, Inc. Dept. 21 Milwaukee 2, Wis.

When no dc current is flowing the permeability of the core is large, hence the inductance is large, as is the inductive reactance, X_L. Since the current in the ac coil is equal to the voltage divided by the inductive reactance or $I=\frac{E}{X_L}$ it can be seen that when the inductive reactance is large the current flow is small.

As the dc current is increased and the reactor core starts operating near the saturation point of its magnetic curve, the permeability starts to decrease very rapidly. As the permeability decreases, so does the inductance and the inductive reactance. As shown in the above formula, the decrease in inductive reactance causes a corresponding increase in current through the ac coil. Therefore, when full dc current flows, practically the only impedance to current flow in the ac coil is due to the resistance of the wire alone.

The wave form of the load voltage is extremely distorted, hence this type of control is suitable only for such devices that use the secondary ac power for heat or light.—H.G.C.

Voltage Drop and Current Flow

QUESTION R22—We had a case recently where a ½ hp oil burner motor would lower the voltage at the 100 amp main switch about 16 volts. At the same instant, the other side of the service (3 wire 2 voltage) would rise about 14 volts.

With the main switch in "off" position, the voltages were 114 volts and 126 volts at no load. So when the motor started, the low side dropped to about 100 volts, and the high side increased to nearly 150 volts.

Two single phase transformers were parallel on secondary side and were located quite distant apart. They both had secondary fuses in each of the two hot wires; neutral was solid.

One of these fuses on the nearest transformer was blown, and replacing fuse seemed to correct practically all of the abnormal variations.

I know that circulating currents, harmonic voltages, and neutral currents can cause some queer conditions, and I have a fair idea of how this came about. However, I want to explain it to others, and cannot make up an understandable sketch or explanation.

Can someone help me out on this without making it too technical or mathematical?—M.C.T.

ANSWER TO R22—The problem is one of voltage drops and current flow in the several branches of a complex circuit. Circulating currents, har-

the lid's off!

NEW **electrical insulation made with**
DOW CORNING SILICONE RESINS
give you unequalled freedom in design, still more power per pound, even longer life and greater reliability

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has over 100 times the thermal life of the best organic varnishes; over 3 times the life of earlier silicone varnishes.

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Electric machines **built with Class H insulation bonded and impregnated with the original Dow Corning Silicone resins have 10 to 100 times the life, or half again as much power per pound as comparable equipment built with the next best class of insulating materials. That has been proved time and again during the past eight years by functional tests and by performance of thousands of industrial motors.**

New Silicone Resins **invented for you by our scientists and engineers have *several times* the dielectric life of the original silicone resins at high temperatures. That means that electrical equipment insulated with the new silicones will last even longer; give you still greater reliability; reduce motor maintenance and down time to the vanishing point; deliver more power per pound than ever before.**

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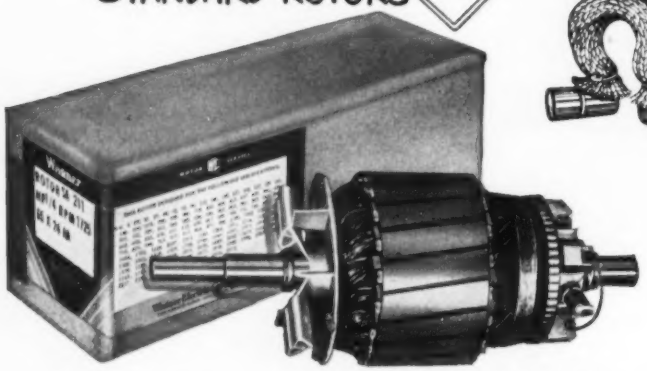
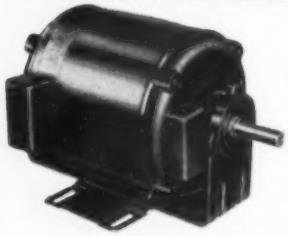
Wagner

STANDARD ROTORS

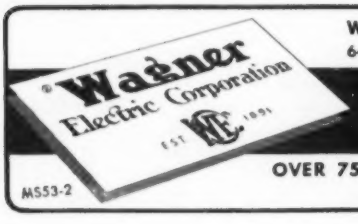


Today—due to constantly rising labor costs—it usually costs you less to replace armatures in fractional hp. motors with Wagner Standard Rotors than to rewind the old ones. There's no guesswork involved—the "tell all" label on the Wagner Rotor Carton, used with the K and M "spec" lists, shows you the *right* replacement unit everytime. If necessary, the shaft can be removed from the standard armature and your special shaft used instead.

it's also wise...and profitable to stock **Wagner** replacement motors



Carry a stock of Wagner motors—to replace motors "too far gone" for economical repair and for emergency use where your customer needs immediate service. You'll find it pays off—and you can often make a ready sale.



MS53-2

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MOTORS · BEARINGS · STANDARD ROTORS
BRUSHES · CAPACITORS · COMMUTATORS

OVER 750 AUTHORIZED SERVICE STATIONS OR PARTS DISTRIBUTORS

monic voltages, and neutral currents all contribute to the same end result, but may be neglected for an explanation.

There was some load on the system as indicated by the unbalanced voltages of 114 and 126 at "no load." The total voltage of 250, when the motor was started, may be questioned as it is hard to read meter swings with any real accuracy.

Two rules govern: (1) the sum of all currents entering a junction point must equal the sum of all currents leaving the junction, and (2) the sum of all voltage drops around a closed loop must equal the sum of the voltage rises around the loop. These are known as Kirchhoff's Laws and permit a mathematical solution of any circuit—although the simultaneous equations usually become quite involved. At this point, too, it is well to turn one's back on the expression: "electricity takes the easiest path." Electricity flows in *all* paths in proportion to the voltage and inversely as the impedance.

Fig. 1 shows a simple circuit with a heavy load on one side of the line and a high impedance voltmeter on the other. This is a simplification of the problem presented, but the principles can be extended to more complex situations. Arrows are placed to show the

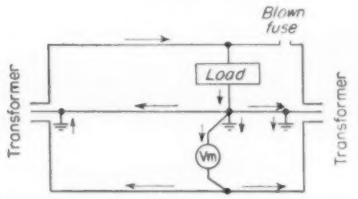

Fig 1

assumed flow of current. If in the mathematical solution a negative result is obtained, it merely means that the arrow was assumed in the wrong direction.

Fig. 2 shows the equivalent circuit with the branches sloping in the direction of voltage drops, somewhat like pitching a water pipe to drain. The closed arrows at the transformers are voltage *rises*. In the present instance, there must be a voltage drop in the neutral because the line load is

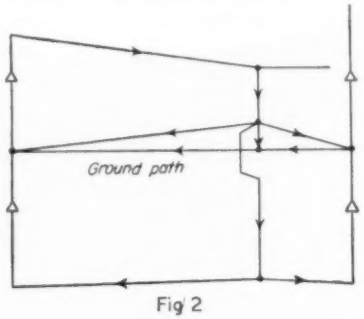

Fig 2

A NEW CONCEPT in *Light Control*

the Wallbox Dimmer

FOR MOUNTING INTO A WALL

- *Smooth, flickerless light from darkness to full brightness*
- *Use in place of ordinary on-off wall switches*
- *Safe, economical and silent operation*
- *Controls any number of lights up to 360 watts*
- *Wallplates to match any room decor*
- *Underwriters' Laboratories Approved*

Now, it is possible to choose the light just right for every occasion, activity, mood and atmosphere.

The WALLBOX Dimmer replaces the ordinary wallswitch to provide complete lighting control from darkness to full brightness. By simply turning the knob, the desired amount of light is selected. A child can operate it. Since it is a transformer, operation is cool and economical. It controls by converting watts — unlike hot resistance type controls that waste wattage. It is safe with fuse and thermal overload protectors.

for

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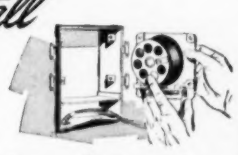
OFFICES
COCKTAIL LOUNGES
RESTAURANTS
HOTEL LOBBIES
HOTEL ROOMS
SCHOOLS
THEATRES
CHURCHES
LODGES
CLUBS
HOSPITALS
and
HOMES

Easy to Install

as the wallswitch in a wall . . . easily wired into the circuit.



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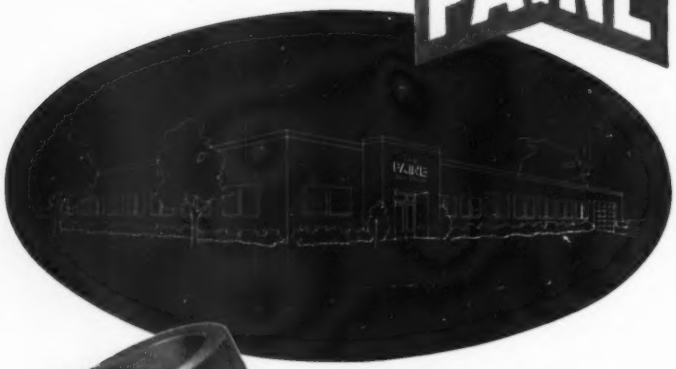
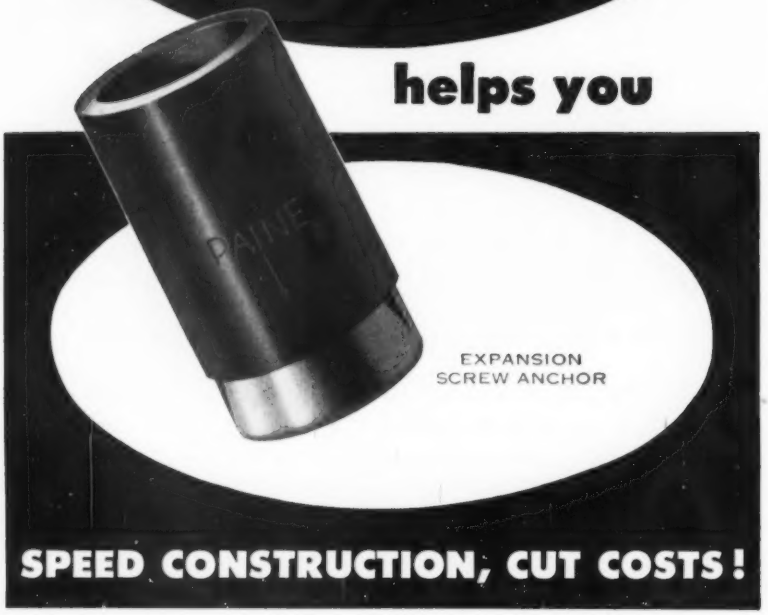


helps you



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Your continued demand for more and more Paine products was a clear call for us to expand. So, in our fortieth year in business, we built a big new plant at Addison, Illinois, just west of Chicago. This enables us to match your orders for Paine hanging and fastening devices, and still maintain that famous Paine quality.

Paine Expansion Screw Anchors will hold in any solid material. They are stamped with the bolt or screw size and thread, have a convenient arrow indicating the hole end. A setting tool in each box makes fast installation easy.

For the holes, use a time-saving Paine "Sudden Depth" Drill.

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Spring Wing Toggle Bolts	Conduit Clamps	Star Drills
Expansion Anchors	Pipe Hooks and Straps	Malleable Shields
"Sudden Depth" Drills	Hanger Iron, perforated	Special Hanging and
Wood Screw Anchors	Expansion Shells	Fastening Devices

not balanced. The load takes more current than the voltmeter. The upper coil of the left-hand transformer has a lower terminal voltage than the lower coil, and the coils in the right-hand transformer because of the internal voltage drop caused by the load. In fact, the voltages of the right-hand transformer have shifted upward on the page with respect to the left-hand transformer.

Starting at the upper left corner of Fig. 2, it will be seen that there is a voltage drop toward the load in the upper line. There is no linedrop to the right of the load because there is no current flow. Further, there is a voltage drop across the load. At this point, the current divides and contributes to voltage drops in the voltmeter, the neutral in both directions, and in the various ground paths toward the neutral of the left-hand transformer. The drops in the upper loop equal the voltage rise in the upper left transformer coil.

Starting at the five-way junction in the center, there is a voltage drop across the voltmeter and another in the lower line toward each transformer. These voltage drops are balanced by the voltage rises through the transformers together with the voltage *rise* in the neutral toward the starting point. The latter can be visualized as a rise when it is remembered that one is moving *against* the neutral arrow when tracing the circuit.

Tracing the loops in directions opposite to that which was explained will present no difficulties if each arrow is mentally reversed as it is encountered. Eliminating the transformer and line to the right of the load and voltmeter will give an illustration of the voltage rise at the end of a 3-wire line as an unbalanced load is applied. The general principles of Fig. 2 may be extended by adding more branches to the circuit, to find that it is quite possible to have the **neutral current** flowing toward the left at some points and toward the right at others—even if there is only one transformer.—L.E.B.

Can you ANSWER these QUESTIONS?

QUESTION C23—We have a steel frame, industrial type building about 500 feet long, with an expansion joint across the middle of the building. The actual movement of this expansion joint is about one inch, as indicated by the paint that has been scraped off. Bridge cranes traverse the length of the building, and where they cross the expansion joint, gaps have been

BIDDLE *Instrument News*

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of Megger Insulation Tester is a reliable field instrument, light, sturdy, with a constant-voltage type generator—no dependence on batteries or other current supply. By far the most popular instrument among electrical plant maintenance men. Easy to use—easy to read—rugged in constant services. **BULLETIN 21-45-ECM**

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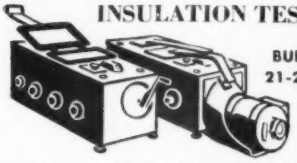

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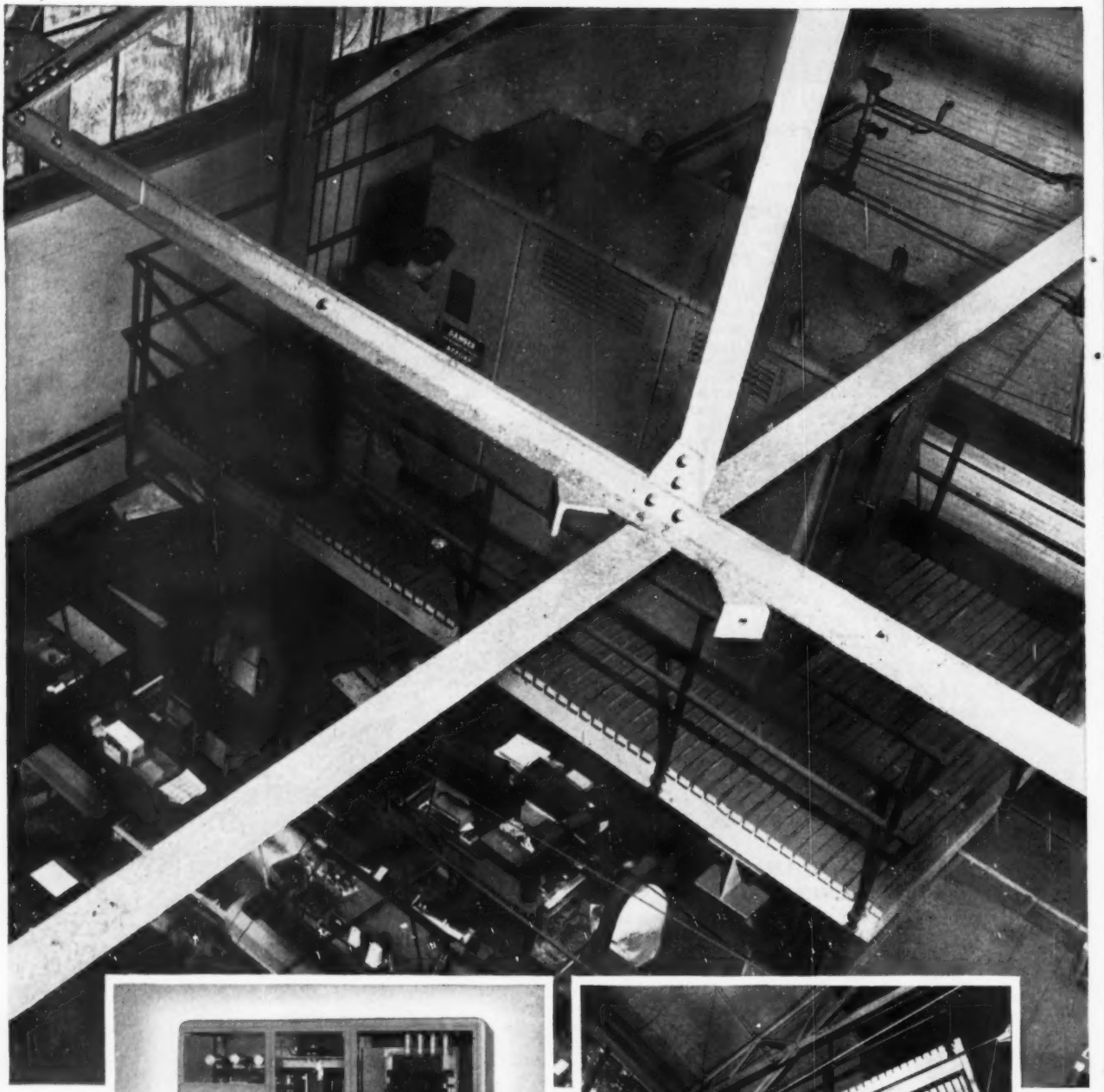

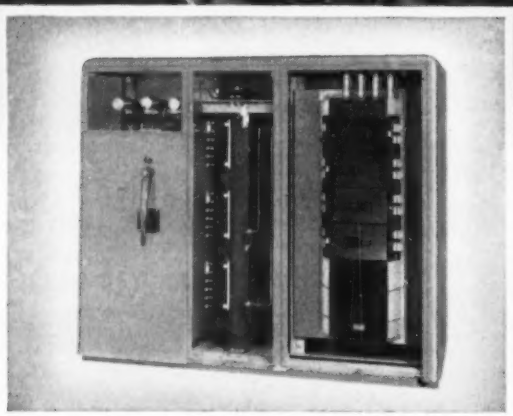

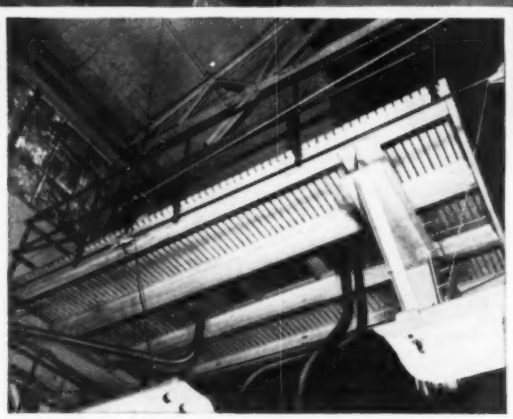

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Change-over from the old system was accomplished section by section, without interrupting production. Each 300-kva integral Power Center, completely assembled, was spotted overhead, close to the center of the load it would serve. Secondary runs were thus shortened, resulting in lower line losses, better regulation, and increased productive capacity of the machinery.

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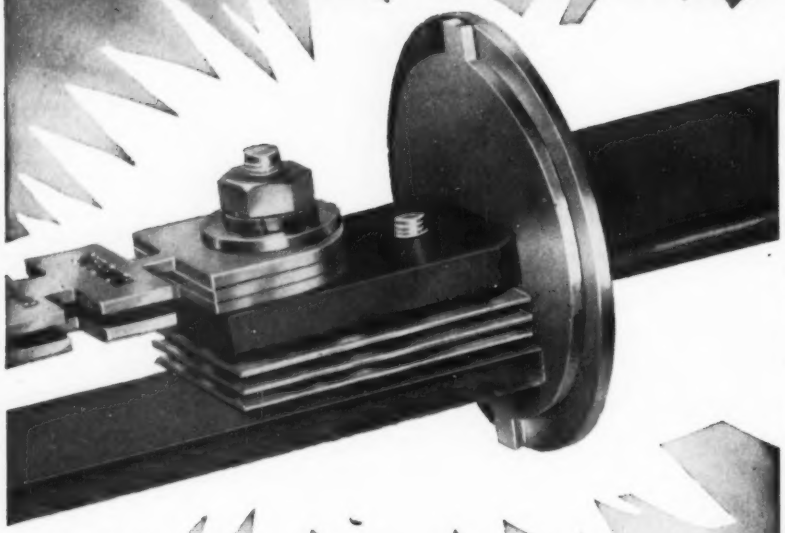

BRASS FINS, assembled at both ends of the fibre bar, not only support the bar securely, but, also, *conduct away excess heat.* This unique MONARCH design gives you *two* distinct advantages . . . *cooler fuses* and *longer fuse life!* Other MONARCH features which assure true alignment, tight links and firm contacts, are further reasons for MONARCH'S *safe protection* and *long economical life!*

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provided in the copper trolley wire crane conductors.

These trolley wires are about to be replaced, and a saving will result if the trolley wires can be run continuously from end to end of the building, with no gaps across the expansion joint. What is the experience of your readers in this regard? Where a long building has expansion joints, must expansion joints also be provided in copper trolley wire crane conductors passing over these joints?—S.O.H.

QUESTION D23—What type of current is the most difficult to interrupt and why—90° lagging current due to idling transformers, in phase currents such as resistance loads or 90° leading currents such as capacitors? Assume each of the three types of currents to be of the same amperage, voltage and frequency.—M.D.

QUESTION E23—I would like an easy and practical method for figuring the starting resistance and how to divide each step. The problem is a 5 hp 440 slip ring wound rotor motor, with a secondary voltage of 250 volts —secondary amps 6,—and 25% starting torque. I want to step all secondary resistance out, in 4 to 5 steps. How do I go about it? D.J.S.

QUESTION F23—What system can I use on a sequence start 8 ft. fixture so that the two bulbs will not go out when the first bulb starts to burn out? —H.S.

QUESTION G23—We have a great many surplus 50 hp 850 rpm 230 volt compound wound direct current motors at our plant. Would it be possible to convert these machines to use as welding generators to be driven by ac motors?—W.P.R.

QUESTION H23—What would be a safe way to use a pressure control on a cone crusher with forced oil feed? I would like to maintain a constant oil pressure, and in case the pressure fails a few pounds, it should stop the crusher and give a signal.—E.H.

QUESTION J23—What is the most simple and economical method of stripping motors?—L.W.F.

PLEASE SEND IN YOUR ANSWERS BY APRIL 15

Now CUTLER-HAMMER *proudly presents the spectacular new ★★★ motor control*

Entirely new in concept and design. Wide-open accessibility. Remarkably improved performance. Vastly increased operating life.

This is important news for the men of industry. It marks a new day of improved electric motor performance. A new day of more accurate and more dependable motor protection. A new day of simpler, easier, faster motor control installation. This is the quick story of the spectacular new Cutler-Hammer [redacted] Motor Control. But thousands of words could not tell this story in its important details.

Cutler-Hammer [redacted] Motor Control can be known *only* by its performance. Field-tested for more than two years in hundreds of the most trying motor control assignments, its first users have said time and again that there has never been anything like it before. And these users were *looking* for faults. You need not be moved by their enthusiasm. But you cannot ignore their factual reports. Try it. Test it. Compare it. Prove it. Your nearby Authorized Cutler-Hammer Distributor is ready to serve you. Order from him today.

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☆ ☆ ☆

★ *installs easier*
★ *works better*
★ *lasts longer*

CUTLER-HAMMER
MOTOR CONTROL
C-H

SEE NEXT PAGE ➡

CUTLER-HAMMER ★★★ MOTOR CONTROL

The 3 Stars stand for 3 New Standards

☆ 1...An entirely new standard of easier, faster, lower-cost motor control installation. Any electrician can prove it.

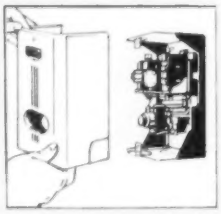
☆ 2...An entirely new standard of dependable motor control performance; reliable uniform response and more accurate overload protection. Any use will confirm it.

☆ 3...An entirely new standard of trouble-free long life; surely the finest starters both electrically and mechanically you have ever known. Any comparison shows it.

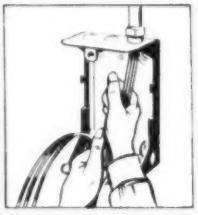
Installs easier...

Factory records everywhere today show the cost of installing motor control is usually much greater than the amount spent to buy the control equipment, often two or three times as much. Here you see why this new, better motor control actually costs less.

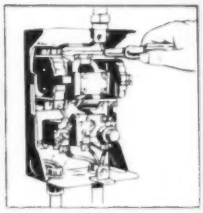
Just loosen two screws and off comes wrap-around cover. Screws stay in cover, do not fall on floor. Just loosen three screws and out comes the entire mechanism on unit plate.



Making conduit connections and pulling wires is a cinch; no starter mechanism in the way. No damaged starter parts or skinned knuckles. Wide-open accessibility, no side walls.

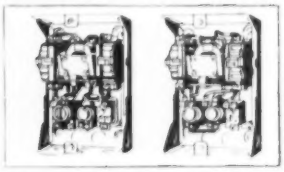


Easy straight-through wiring. All line terminals are at top, all load terminals at bottom. All terminals visible from front, all with solderless pressure connectors. Plenty of wiring room.

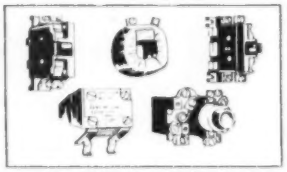


Works better...

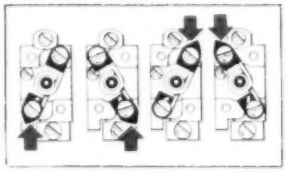
Better performance; dependably uniform operation, trouble-saving and cost-cutting more accurate overload protection. These are more than mere claims in this new Cutler-Hammer control. Field-tested over two years. Compared with every make of control by actual users...to have most say, "Better than anything we have ever used!"



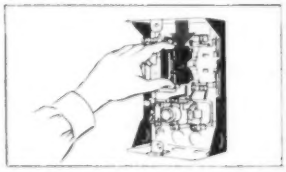
3-Coil Overload Protection. Another Cutler-Hammer "first," complete protection against single phasing as an optional feature in standard starter construction in standard enclosure.



5-Unit Construction. Just five units... magnet coil, armature, two contact blocks, and overload relay...and any unit can be removed from *front* without disturbing any other.



4-Position Overload Coils. Famous C-H Eutectic Relay now adjustable so motors can work harder *safely* without nuisance tripping. Each coil offers range of 4 ratings, selected by positioning.

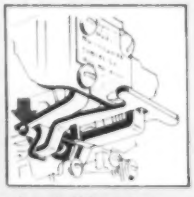


Electrical Interlocks. Interlock blocks easily added to provide up to 4 extra control circuits; normally open, normally closed, or both.

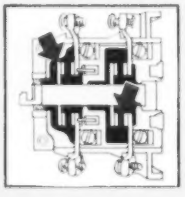
Lasts longer...

Many users will ask, "Why longer life? We have never had a Cutler-Hammer starter wear out!" But there are two reasons for even longer life. First, it brings better performance to those "killer" jobs where industry expects Cutler-Hammer engineering leadership to prevail. Second, and most important, it decreases the *rate* of wear to the point where maintenance care and cost are virtually *eliminated* on most installations.

Armature pivoted on a rolling bearing for smooth, quiet operation. No rubbing, no sticking, no slamming. New light-weight moving parts. Less weight, less bounce; less bounce, less arcing.



New pressure-quench arc chambers. Heat of any arc rapidly expands confined air; increased pressure snuffs arc. Contacts are *vertical* dust-safe design; twin-break contacts further minimize arcing.

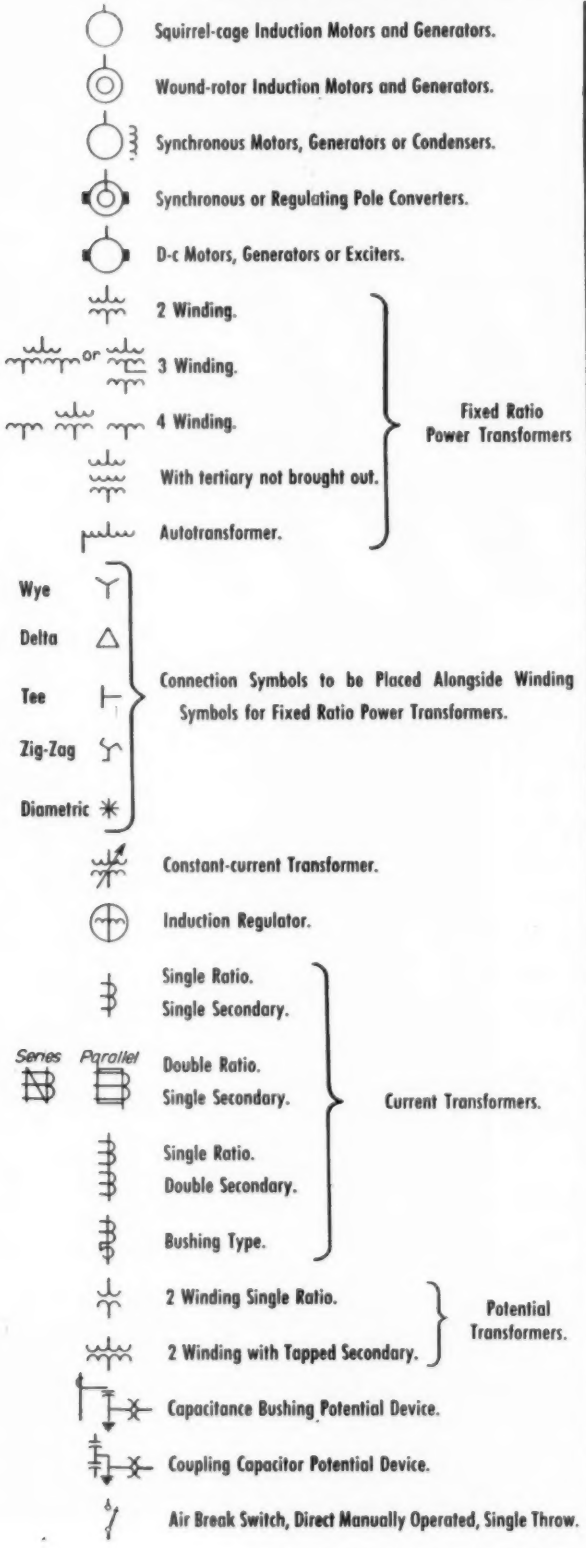


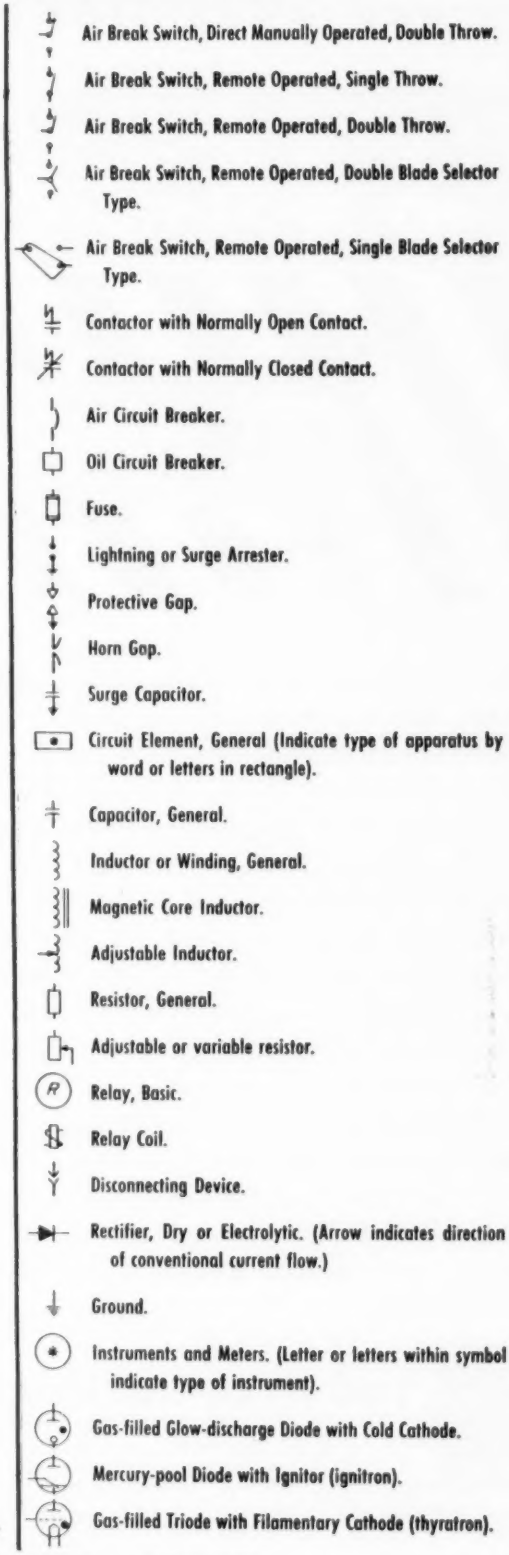
Cutler-Hammer, Inc.—Milwaukee 1, Wisconsin

CUTLER-HAMMER ★★★ MOTOR CONTROL

Data Sheet

GRAPHICAL SYMBOLS FOR ONE LINE ELECTRICAL DIAGRAMS




Air Break Switch, Direct Manually Operated, Double Throw.
Air Break Switch, Remote Operated, Single Throw.
Air Break Switch, Remote Operated, Double Throw.
Air Break Switch, Remote Operated, Double Blade Selector Type.
Air Break Switch, Remote Operated, Single Blade Selector Type.
Contactor with Normally Open Contact.
Contactor with Normally Closed Contact.
Air Circuit Breaker.
Oil Circuit Breaker.
Fuse.
Lightning or Surge Arrester.
Protective Gap.
Horn Gap.
Surge Capacitor.
Circuit Element, General (Indicate type of apparatus by word or letters in rectangle).
Capacitor, General.
Inductor or Winding, General.
Magnetic Core Inductor.
Adjustable Inductor.
Resistor, General.
Adjustable or variable resistor.
R
Relay, Basic.
Relay Coil.
Disconnecting Device.
Rectifier, Dry or Electrolytic. (Arrow indicates direction of conventional current flow.)
Ground.
Instruments and Meters. (Letter or letters within symbol indicate type of instrument).
Gas-filled Glow-discharge Diode with Cold Cathode.
Mercury-pool Diode with Ignitor (ignitron).
Gas-filled Triode with Filamentary Cathode (thyratron).

EXPLOSION-PROOF and DUST-TIGHT

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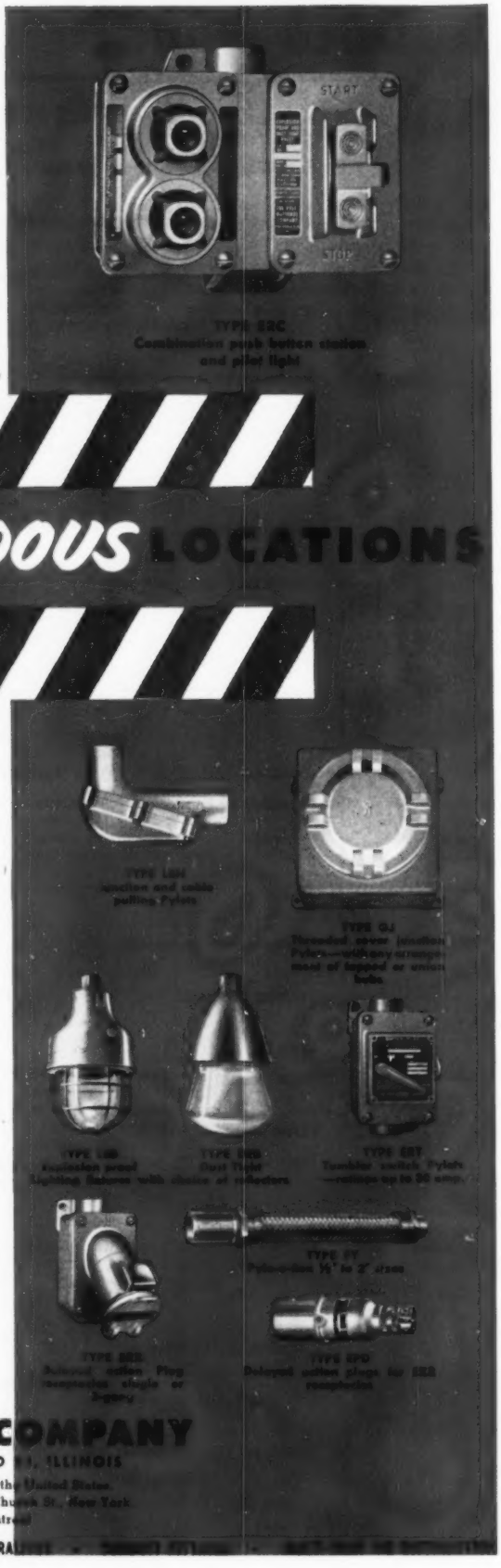

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Questions on the Code

Answered by

B. A. McDONALD, *New York Board of Fire Underwriters, Rochester, N. Y.*
GLENN ROWELL, *Electrical Engineer, Fire Underwriters Inspection Bureau, Minneapolis, Minn.*
B. Z. SEGALL, *Consulting Electrical Engineer, New Orleans, La.*
F. N. M. SQUIRES, *New York Board of Fire Underwriters, New York, N. Y.*

Raceways

Q. *We have been asked whether we would accept an installation in which conduit runs are to be supported on short lengths of angle iron suspended by ½-inch rods from bar joist roof construction, with these hangers to be located at 10-foot intervals with the conduit simply laid in place on the angle iron cross members. Conduits will vary in size from ½-3 inches and will not be fastened in any manner other than by gravity to the angle iron horizontal members of the hangers. We hesitate to accept this type of installation and would like to require that the conduits be clamped to this horizontal angle iron support. Will the Code back us in this requirement?*—D.C.

A. Section 3004 of the Code states very clearly that unless otherwise provided raceways shall be securely fastened in place and inasmuch as Article 346 contains no exceptions to this requirement, it is mandatory that the raceways, or conduits in this case, be fastened to this horizontal supporting member in such a manner that they will be permanently held in place. This may be by means of a U type bolt or a clamp or any other suitable means which would assure their staying in position.—G.R.

Riveter Motor Control

Q. *We have been wiring the riveters according to Fig No. 2. We have been requested to wire some riveters as shown in Fig. 1. I feel that a code violation exists in Fig. 1. Party requesting Fig. 1 argues that such a circuit is necessary from a standpoint of safety to the operator as injuries have resulted from Fig. 2 circuit wiring. Operator would sometimes forget to shut off the relay line switch while remembering to shut off the motor switch. If the flywheel on the riveter is coasting and the hand switch is accidently touched, the riveter will trip. This sometimes causes an accident as the operator becomes a little careless thinking that as long as the motor is turned off that the riveter cannot trip. Therefore, we have been asked to wire circuit as in Fig. 1. There is no additional room on riveter for other auxiliary devices. Please comment.*—P.P.G.

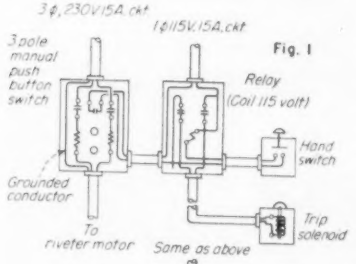

Fig. 1

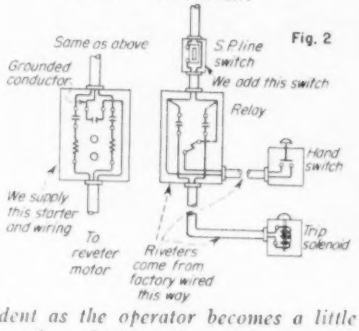

Fig. 2

A. I am unable to see any Code violation in the wiring circuit shown by Fig. 1. The principal rule involved appears to be Section 4406 which requires a motor disconnecting means to disconnect both the motor and the controller from all ungrounded supply conductors. In Fig. No. 1 the 3 pole manual switch serves both purposes. Two poles are used to disconnect the ungrounded conductors serving the motor and one pole is used to disconnect the ungrounded conductor serving the controller. In other words, the motor switch disconnects both the motor and the controller from all ungrounded conductors when it is in the open position.

The method shown in Fig. 2 is also recognized by the Code. A three pole switch would not be required in this case since the Code does not require the grounded conductor to be disconnected. In this case the additional single pole switch, ahead of the controller would be required and is recognized by Section 4374 which permits a separate switch to disconnect the control circuit from its power supply if located adjacent to the motor switch. It is evident from your comments that a hazard could result with this method when both switches are not opened and it is not confined to this one application. When this method is used on air-conditioning circuits, it is also essential that both switches be used if we wish to avoid a hazard, since the operation of the motor switch only may leave potential at both the motor and the controller.—B.A.McD.

Corrosive Resistant Materials

Q. *In a certain industrial installation we are required to use corrosive resistant materials. What are these materials and for what particulr types of corrosion are they to be used?*—J.M.

A. This is quite a problem and in general its solution requires the cooperative efforts of the designing engineer, the inspector and the plant's chemical engineer. It is impossible for the writer to even attempt to indicate an overall solution to this corrosive problem. Many of the answers are beyond the ken of his knowledge.

There are hundreds of chemical processes involving the manufacture of many thousands of chemicals and materials. Combine these processes with the corrosive effects indigenous to certain areas, i.e., the corrosive effect of salty atmospheres on the Gulf and Ocean coastal areas, the high humidity inherent in other sections of the country, etc., and you have corrosive problems, galore.

The code recognizes, through Underwriters' Laboratories, Inc. approvals, several types of corrosive resistant materials. These will range from non-metallic types such as "Bermico", "Transite", "Orangeburg", etc., to special finishing paints as described below.

Here again the use of any one type

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may be controlled by the class of electrical installation involved. Thus in a hazardous location as defined in Article 500 of the Code, the general wiring method requires the use of rigid metal conduit. Therefore, non-metallic types of conduit would not be installed for corrosion control in these hazardous areas. Corrosive resistant finishes on standard rigid conduit or corrosive resistant rigid non-ferrous metallic conduit would be installed.

As to corrosive resistant finishes, these are generally available from many manufacturers as supplementary paints, lacquers, etc. To mention only two, Subox Inc. and Tropical Paint & Oil Co. have some very fine anti-corrosive paints. Here again it must be emphasized that no one paint will be a "cure-all" for every corrosion effect.

Approved rigid non-ferrous metallic conduit may be obtained in aluminum and copper. These non-ferrous conduits may be used to combat the corrosive effects in many plants. Here again the specific application of their use can best be determined by the process or chemical engineer in the plant.

The conduit fitting manufacturers are in a position to furnish special metals and finishes. Thus the Crouse-Hinds Co. can furnish many of their fittings in cast aluminum, cast bronze (including silicon, phosphor and aluminum bronze) cast brass and cast lead.—B.Z.S.

Circuits for Lighting

Q. *When wiring filling stations, we are often called upon to run circuits for light outlets located on poles mounted on the dispensing islands and elsewhere about the property. Some of these standards for lighting are of pipe construction and others are of cast metal construction, yet it is always common practice, in the past at least, to use these standards as wireways. Is this permissible and what is the proper method of bringing a conduit run into such a lighting standard?*
—G.J.

A. I feel that your question is rather well answered under Section 5143, which reads as follows: "In an outside location, all wiring and equipment less than 4 feet above the adjacent ground or apron level, and less than 20 feet horizontally from any dispensing island or pump, tank fill-pipe, or tank vent-pipe, shall conform to the provisions of Article 500 for Class I, Division 2 locations, unless the authority enforcing the Code specifies conformance to requirements for Class I, Division 1 locations. Approved

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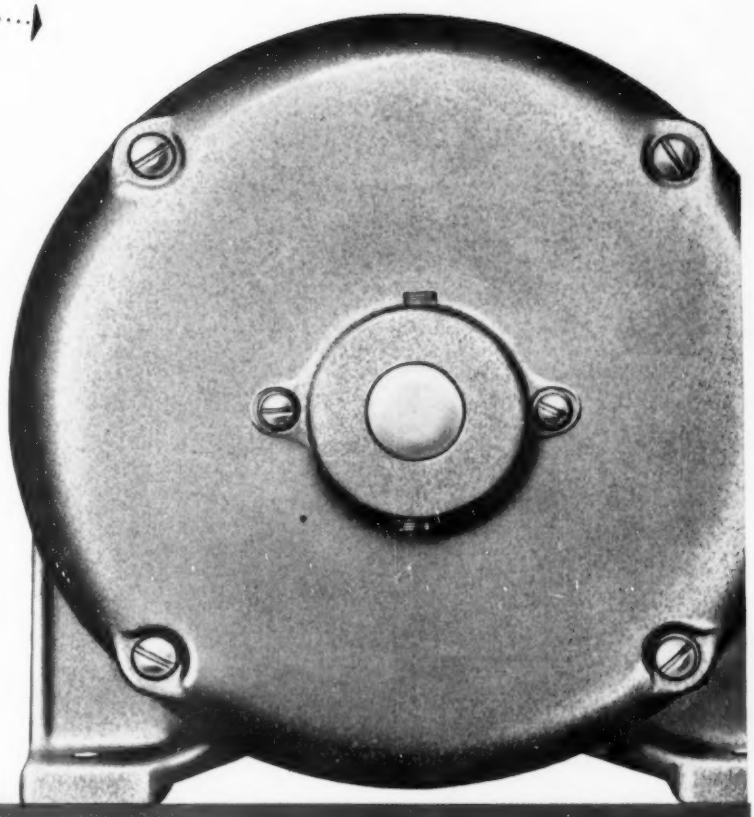

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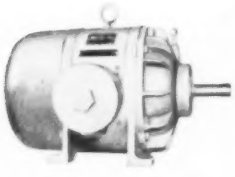
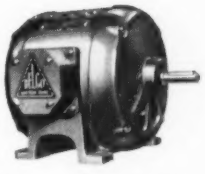
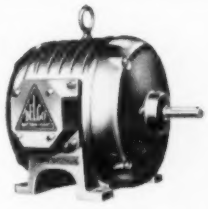


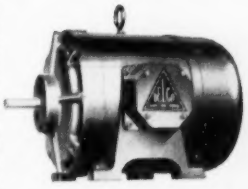
Explosion-Proof Motor



Open Ball-Bearing Motor



Totally Enclosed Motor



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seals shall be provided in all conduit runs leaving the defined area."

Therefore, a circuit in conduit to a pole standard must have a sealing fitting at some point above the 4-foot level when that standard is within 20 feet of a dispensing island or pump, tank fill-pipe, or tank vent-pipe and as it is often impossible to use a sealing fitting within a standard, it is necessary to run your conduit up outside the standard sufficiently high to reach above this 4-foot level and then one may pass into the standard so the sealing fitting can be outside where it can be properly filled with sealing compound. Standards constructed of ordinary conduit can, of course, be used as wireways. However, cast metal standards which have not been treated to remove all sharp edges cannot be so used making it necessary to employ some type of raceway above this 4-foot level for protection of the insulation on the circuit conductors.
—G.R.

Grounding Washing Machines

Q. *We note in your November issue a Code question on grounding washing machines.*

The washing machines that are coming to us only have the two-wire cord, but most of your electric drills are with the three wire cord, so that you can connect same to water pipe. We have in most cases taken the old two wire cord off and replaced same with a three wire cord the third wire being connected to the frame of the washer, and our three pole receptacle, we would take our third wire, or ground and run that to the water pipe, as per our diagram below.

Kindly advise us if this, in any way, violates the Code.—K.E.

A. At the present time the Code, under Section 2545, covering the grounding of portable equipment, does not require the grounding of the frames of washing machines, operating

CLEANEST and EASIEST

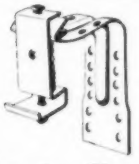
TROFFER INSTALLATION I EVER MADE says:

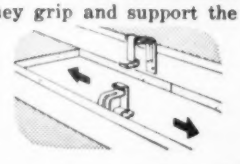
Mr. Frank Coughlin
J. Livingston and Company
Boston, Massachusetts

"You normally expect headaches with a recessed troffer installation, but the Smithcraft Troffer installation in the New Hampshire Fire Insurance Co. in Manchester, N. H. was fast, clean and easy. And the finished appearance was something we could really be proud of! Undoubtedly, the Smithcraft Aligner Hanger had a lot to do with it. It eliminated the need for careful dimensioning and locating of hangers and we could level the troffers easily even after the wiring was completed and the ceiling in place."

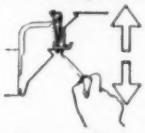
●

That's the way it is with Smithcraft Troffer installations! Smithcraft Troffers can be installed in a fraction of the usual time required. They can be installed in any type ceiling construction . . . *and installed right!* Smithcraft Aligner Hangers (Patent No. 2,597,875), four or six to a frame, are mounted almost haphazardly without critical measuring. They grip and support the housing securely. After the wiring is completed, the reflector





is installed and the troffer is then levelled with the ceiling by simple screwdriver adjustment of the Aligner Hanger. The cover plate is inserted and the shielding medium is swung into place.



Smithcraft Troffers are available with a wide variety of shielding components for one, two or three 40-watt Bi-Pin (Regular or Rapid-Start) or 48", 72" and 96" Slimline Lamps. For appearance, ease of installation, simplicity of maintenance and lighting performance, the Smithcraft Troffer is in a class by itself.

Shown below are views of the Smithcraft Troffer installation in the offices of the New Hampshire Fire Insurance Company, Manchester, New Hampshire. *Architect:* CRAM AND FERGUSON, BOSTON, *Electrical Engineers:* THOMPSON ENGINEERING COMPANY, BOSTON, *Electrical Contractors:* J. LIVINGSTON & COMPANY, BOSTON.

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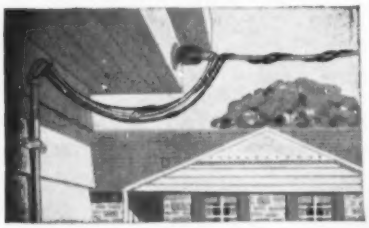

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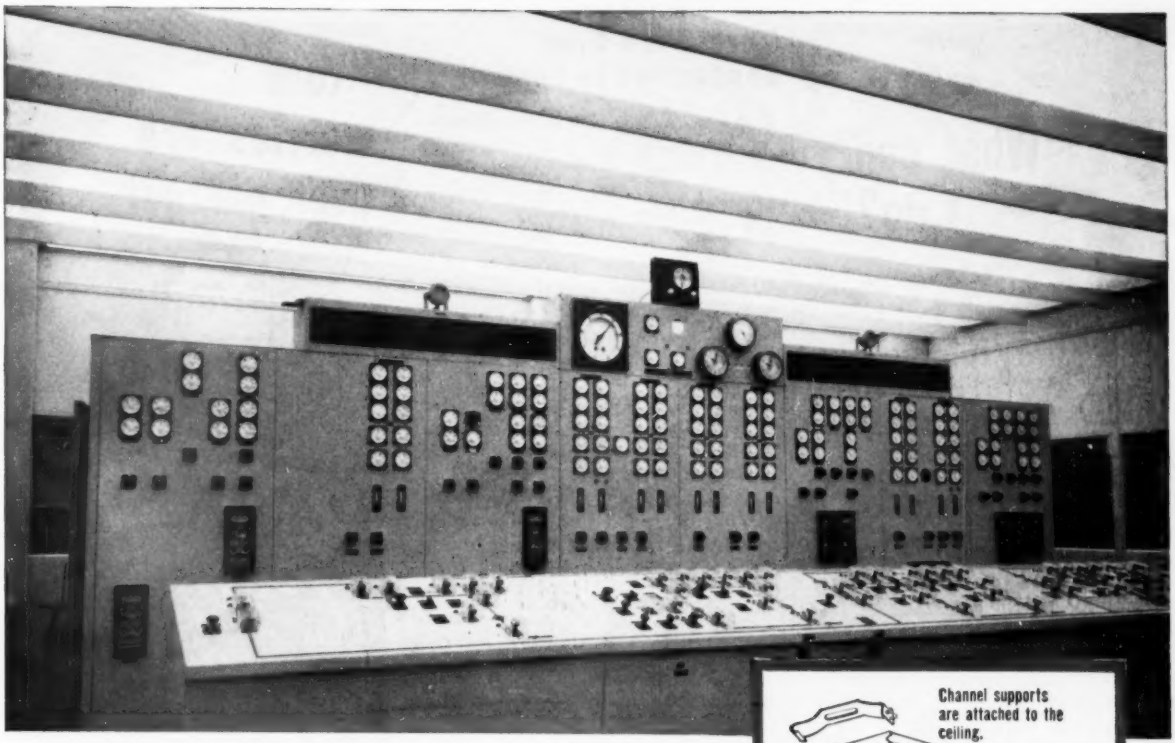
at less than 150 volts to ground, in a residential occupancy even though they may be used in conductive locations. In any other type of occupancy, a metal washing machine frame or any exposed metal parts of same must be grounded under the conditions described in Section 2545-c.

In contrast with this rule. Section 2124-b requires in a dwelling occupancy, the installation of a 3-pole type receptacle designed for grounding to be installed for the connection of laundry equipment, which undoubtedly covers a washing machine. While Section 2545 does not require the grounding of the machine, Section 2124-b indicates it is desirable to do so and infers that such a ground should be made through the use of a 3-wire cord and a 3-pole type receptacle.

I assume from your drawing that the receptacle is served by a non-metallic wiring method which affords no path to ground like any of the metallic systems of wiring would. I also assume that there is no bare grounding conductor in the non-metallic cable assembly. It is also possible that the outlet box is non-metallic. Under these conditions, there is no alternative, without rewiring the circuit, to grounding the receptacle grounding terminal other than you show in your diagram. At the present time there is a proposed Code change under Section 2115-b which would require a non-metallic cable feeding a laundry receptacle to include in its assembly a grounding conductor to which the contacts of the grounding receptacle shall be connected. This rule however is not as yet accepted and if it was, it would not help us on the old jobs. It indicates that considerable thought has been given the subject under discussion and eventually the correct solution will be found.

In direct answer to your question, it is my opinion, that there is no Code violation by the method shown in your diagram since the Code does not require the washing machine in a residential occupancy to be grounded. If the Code did require such grounding, I believe according to the present Section 2592 that the grounding conductor run from the receptacle terminal to the water pipe when smaller than No. 6 would have to be protected by cable armor. There is also a proposal to modify this requirement before the electrical committee at this time. On new work and also alterations, I believe we should promote the use of a grounding conductor in all non-metallic cable assemblies as a dependable method of grounding both fixed and portable equipment, when such cables are not exposed to mechanical injury.—B.A.McD.



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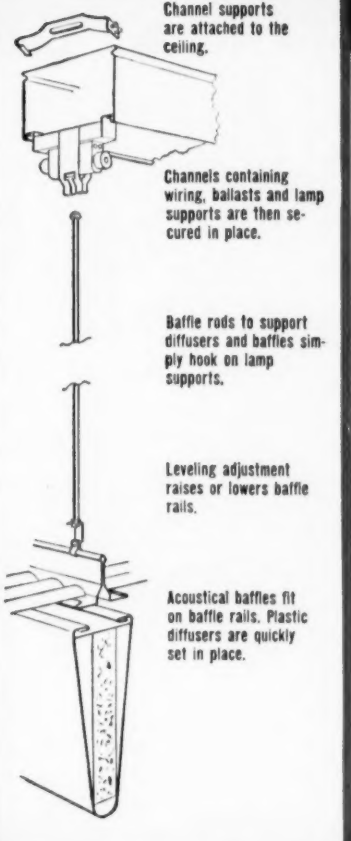
5. Qualified contractors are invited to become Wakefield-licensed installers. Wakefield will furnish a factory man for on-the-job training in the early stages. Write to The F. W. Wakefield Brass Company, Vermilion, Ohio.


Channel supports are attached to the ceiling.
Channels containing wiring, ballasts and lamp supports are then secured in place.
Baffle rods to support diffusers and baffles simply hook on lamp supports.
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Acoustical baffles fit on baffle rails. Plastic diffusers are quickly set in place.

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"And when my cords are ruined, my budget is ruined.

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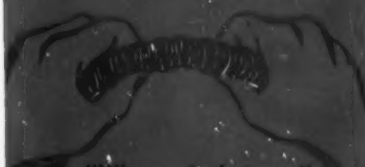
"We inspect cords on the assembly line regularly.



"When a jacket swells and cracks, we replace it right then and there.

"It keeps the plant running, but the maintenance costs are out of sight.

If oil is ruining your cords and cables, switch to Neoprene-jacketed Bronco 60 Certified. Just any "Neoprene" jacket will not do. Be sure your cable jacket is made with a *sufficient quantity* of Neoprene. Be sure the cable you get is Bronco 60 with jacket CERTIFIED to contain not less than 60% Neoprene *by weight*.

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More Than Nine Conductors In Conduit

Q. *May more than nine conductors be installed in a conduit or tubing?*—S.S.

A. It should be noted that Table 4 in Chapter 10 shows only a maximum of nine conductors in a conduit or tubing. For general wiring installations, it would seem that nine conductors would be the maximum number permitted in a conduit or tubing.

However, a fine print note in the heading of this Table refers to Table 9. This Table indicates that more than nine conductors may be installed in a conduit or tubing "when specifically permitted by this code". These special permissions are made for the following types of installations:

1. Conductors between a motor and its controller,
2. Conductors for stage pocket and border circuits,
3. Conductors between a sign and its flasher device,
4. Conductors for elevator control.

These four classes of installations operate so as to intermittently load the conductors of the circuit. At no time is it intended that each and every conductor in these circuits will be fully loaded for concurrent continuous loads. Some conductors may be loaded to full capacity at some point during the operating cycle, but at the same time the other conductors in the circuit may be only partially loaded or even entirely without loading. In other words, there will always be a diversity of loading in the various conductors of the circuit.

Another point to consider is the Note 4 to Tables 1 and 2 of Chapter 10. This note specifically refers to the use of current carrying reduction factors. The maximum factor shown is for nine conductors in a raceway or cable. This would seem to indicate that this is the maximum number of conductors to be permitted for any type of raceway or cable.

However, here again are shown some exceptions as noted in the fine print note at the end of Note 4. These exceptions are:

1. Installation of conductors in wireways (see Section 3624) where in general a maximum of 30 conductors are permitted, except,
   a. for wiring for control conductors between a motor and its starter used for starting duty only, or
   b. for signal circuit conductors, and

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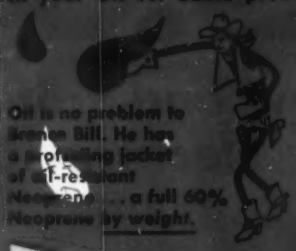

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c. that in either case the cross sectional area of these conductors is less than 20% of the wireway interior cross sectional area.

2. Installation of conductors in an auxiliary gutter (see Section 3745) where the limitation is to 30 conductors, except as noted for wireways,

3. Installation of conductors for Class 1 System of Remote Control or Signal Circuits (see Section 7265). From the above it would seem that in general, even in those cases where more than nine conductors are to be installed, as for example, in wireways and auxiliary gutters, these will be for conductors for intermittent use types of installations as enumerated for use in Table 9. Actually it is known, that in many cases these conductors are being used for general lighting and power circuits, as is the case where these are installel in "Cellular Metal Floor Raceways" such as the Robertson "Q" type of duct.

Incidentally, at the present time the Code current derating factors apply to this type of installation since no specific mention is made for any exception for this Cellular raceway as is made for both the wireway and auxiliary gutter. This question is now under study by a special code committee.

So the question arises whether or not more than nine conductors may be installed for general lighting and power circuits in any raceway or cable. If so, does the final derating factor of 70% for a maximum of nine conductors as shown in Note 4 apply equally as well to all conductor installations involving more than nine conductors?

At present the Code does not have a direct answer to this question and its related problems. It is now being thoroughly studied and will be covered in some future code.—B.Z.S.

Appliance Circuits

Q. *I have just been advised by the local inspector that in the future he will require two and possibly three appliance circuits in nearly all homes and that it will be necessary for us to obtain permission before using only a single appliance circuit in any home in this city. Has the Code been changed in respect to running appliance circuits, or is this some local ruling?*—B.D.

A. The Code has not been changed, however, it is true

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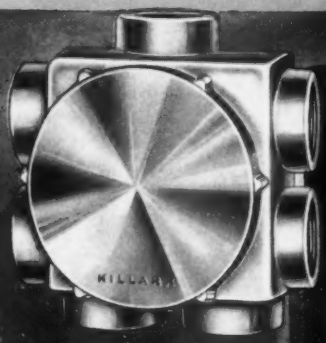

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GENERAL ELECTRIC

that in all too many instances contractors have been using single circuits where two or more circuits actually were necessary due entirely to the great number of appliances in use in our better class homes today. Paragraph b. under Section 2115 states that one or more branch circuits shall be provided for all appliance receptacle outlets. Then in the last sentence in the last paragraph of sub-section a. of Section 2116 you will notice the following requirement:

"The provisions of paragraph b of this section shall apply to all receptacle outlets other than those considered as outlets for general illumination."

Therefore, outlets on appliance circuits are limited in number and actually the amperage rating of the appliances to be connected must be estimated when determining the number of such circuits to be installed. A casual check of the electrical appliances in the average home soon reveals the necessity of at least two circuits in practically all of the smaller homes.
—G.R.

Gasoline Pump Switches

Q. *Article 510, Section 5142-d requires that all circuits supplying dispensing pumps shall be controlled by a switch having a disconnecting pole in each conductor. Why should this not also require that the switch be in sight of pump or could be locked in open position when pumps are to be serviced? Some install a double pole toggle switch in panel with other toggle switches. These could be very easily replaced with single pole switches later and defeat the whole safety plan.*—A.N.E.

A. Section 5142-d, which requires all circuits supplying dispensing pumps to be controlled by a switch having a disconnecting pole in each conductor, first appeared in the 1946 code. The reason for disconnecting all conductors, including grounded conductors, is to afford greater protection when the pump is being replaced or repaired by eliminating the hazard of the grounded wire becoming live due to polarity reversal or other conditions and thus present both a fire and personal injury hazard if it was not disconnected. Assuming this to be the objective desired, it appears to me, as you have pointed out, that some provision should be made to assure the electrician that the switch will remain in the open position when the pump is being serviced. In support of this view, the Code recognizes disconnecting means for Services,

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Motors, Signs, etc, without a disconnect pole in the grounded conductor but in all these cases, it does require that the disconnect be located within sight of the device location or to be arranged to be locked in the open position. As a result, it appears inconsistent when considering the hazard of the gasoline pump to require the disconnect to open all conductors and then to disregard the clause, so common to disconnects, that would assure the disconnect to remain open when desired.

I note in Abbott's Code Handbook the following comment in connection with this rule; "If these circuits are controlled at a panel, a special panelboard is required". I fail however to see where the rule infers that such action should or must be taken. In view of the foregoing, I agree with your comments and believe they are worthy of consideration by the NE Code Electrical Committee.—B.A. McD.

Dwelling Receptacle Outlets

Q. *We recently did some rewiring in an old residence; adding new circuits and installing additional receptacles and lighting outlets on existing circuits. We were criticized because some of the lighting outlets and several of the receptacles in the bed rooms and bath were tied into existing circuits feeding the receptacle outlets in the kitchen and the dining room. Why is this a code violation since we are only adding additional outlets to an installation which was adequate even based on the latest Code requirements?*—J.A.

A. Section 2116d1 governs in general additions to existing installations. But Section 2115b may be the section the inspector is basing his criticism on.

Since from your description, this is rather an extensive rewiring job the inspector may be inspecting this residence on the basis of the Code rule in effect at the time the rewiring was expedited. This is usually a correct procedure recognized by most local ordinances.

Referring to Section 2115b it will be noted that the circuits or circuit feeding receptacle outlets (including clock outlets) in the kitchen, laundry, pantry, dining room and breakfast room cannot be used to feed any other outlets or receptacles. You have connected other outlets to these special circuits and this is a Code violation.

Many contractors overlook this rule and forget to segregate the outlets when rewiring old residences.

Incidentally, many inspectors will permit one keyless porcelain outlet for a lamp to expedite the installation of a lighting unit near a laundry location when this laundry machine is in a building detached from the main residence building. This eliminates the need for running two wires for the washing machine outlet, and then two additional wires, tapped to a general lighting circuit, for the single lamp.—B.Z.S.

Conductors

Q. *I have just been offered an opportunity to purchase some light gray colored insulated wire of the Type T rating. May this light gray wire be used as the identified conductor in circuit wiring or must it be colored white?*—A.D.

A. Section 2006 states that conductors having white or natural gray covering shall not be used other than as conductors for which identification is required by Section 2001, and Section 2001 simply sets up the requirement for identifying the neutral. Therefore your gray wire, if it can be considered as a natural gray, may be used as the identified grounded conductor.—G.R.

Exit Lighting

Q. *What is the light level or intensity of illumination required by the Code for the lighting of stairways in public buildings, such as an auditorium or schoolhouse?*—F.F.O.

A. The National Electrical Code does not prescribe just where emergency illumination is required. Therefore we have to refer to the Code prescribed by the municipality, state or other political subdivision in which the building in question is located and invariably you will find that these political subdivisions base their requirements upon the Building Exits Code as published by the National Fire Protection Association and in that code you will find under Section 1202 the following ruling: "The floors of exitways of buildings used for public assembly or congregation, schools, department stores, factories, mills and other occupancies as required by the several occupancy sections of this code shall be illuminated at all points, such as angles and intersections of corridors and passageways, stairways, landings of stairs and exit doorways

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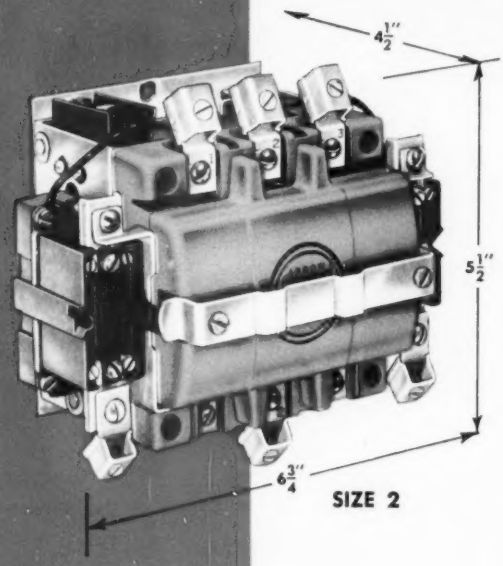
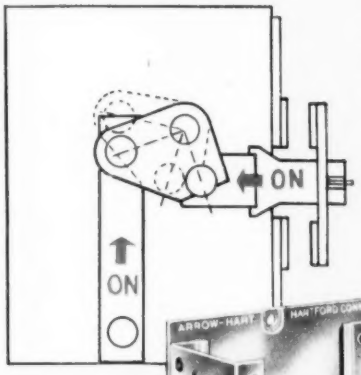


SIZE 2



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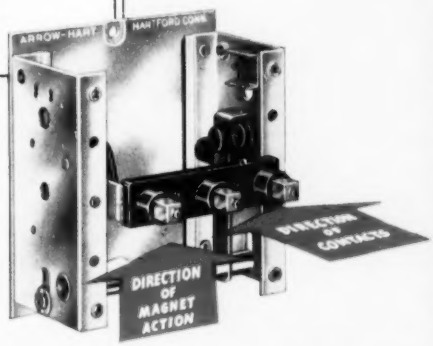

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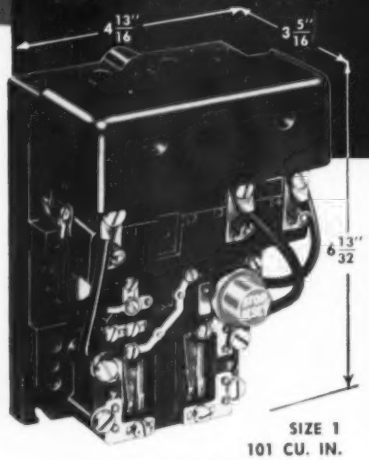

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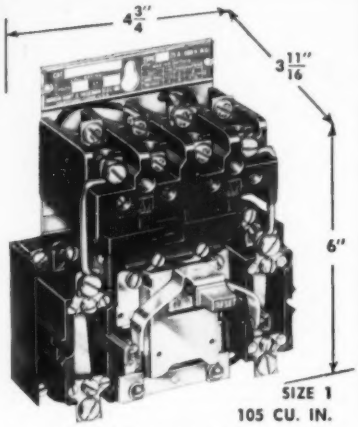
STARTER



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ARROW-HART'S
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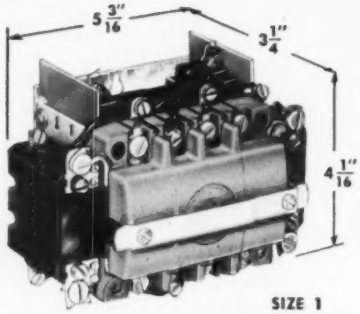

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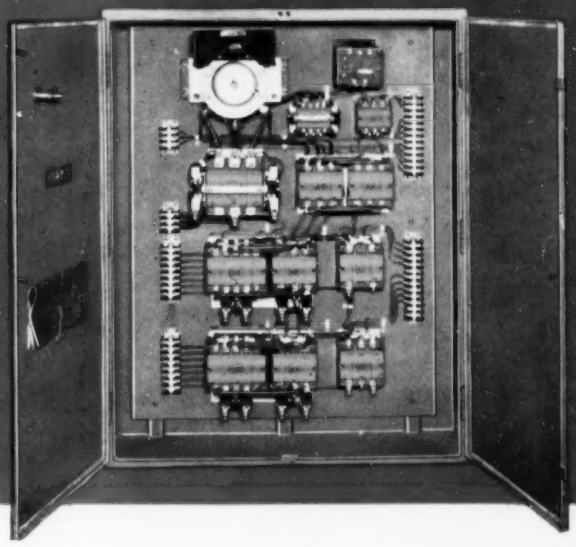

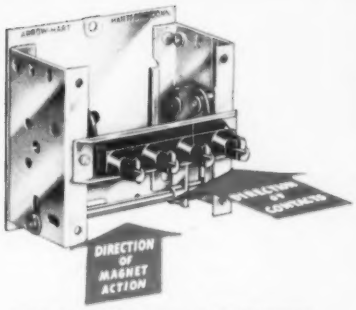

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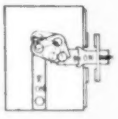
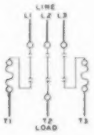


GUIDED CONTACT TRAVEL



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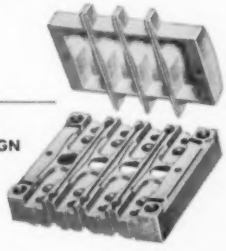

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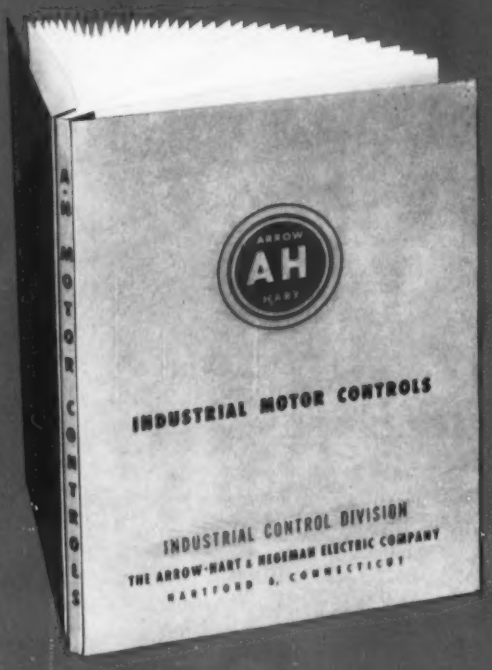

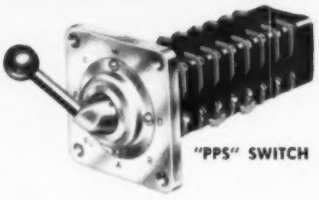
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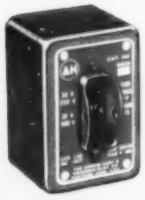
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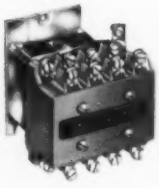
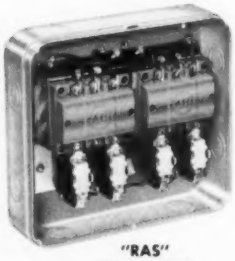

"OO" CONTACTOR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to intensities of not less than one footcandle. In auditoriums and other places of assembly where pictures, motion pictures or other projections are made by means of directed light, the illumination of the floors of exitways may be reduced during such periods of projection to intensities of preferably not less than 1/5 of those prescribed under the above paragraph. At all other times the full intensity of illumination should be as required in the above paragraph." Therefore in the installation of emergency lighting circuits for buildings within this class, provision should be made which will assure a minimum of not less than one footcandle in all stairways and hallways leading from rooms in which the general public may go forth to the outside of the building.—G.R.

Conductor Carrying Capacity

Q. *When two 3-phase feeders (6 wires) are run in parallel in the same conduit, is the allowable current carrying capacity of each conductor reduced to 80%—N. E. Code, Chapter 10-Note 4.*—A.H.H.

A. Since the objective to be attained by the above requirement is to limit the combined heat which results from the I^2R losses in conductors installed in raceways or cables, it appears evident that as the number of conductors so installed increase, the heating likewise increases. In other words, an installation consisting of six wires in a conduit, loaded near recognized capacity, will run hotter than an installation consisting of three conductors, since the I^2R loss of each conductor is involved. The fact that such conductors are run in parallel does not, in my opinion, alter the result. Six conductors in a conduit run either in parallel or as separate circuits, serving the same load, would produce the same I^2R loss. In view of the foregoing reasoning, it is my opinion that the current carrying capacity of the conductors run in parallel as covered by your question, must be reduced to 80% of such values.—B.A.McD.

Grounding of Residential Portable Equipment

Q. *We have recently installed quite a few portable window air conditioners, ¾ and 1 ton sizes, in residences. On several occasions we*

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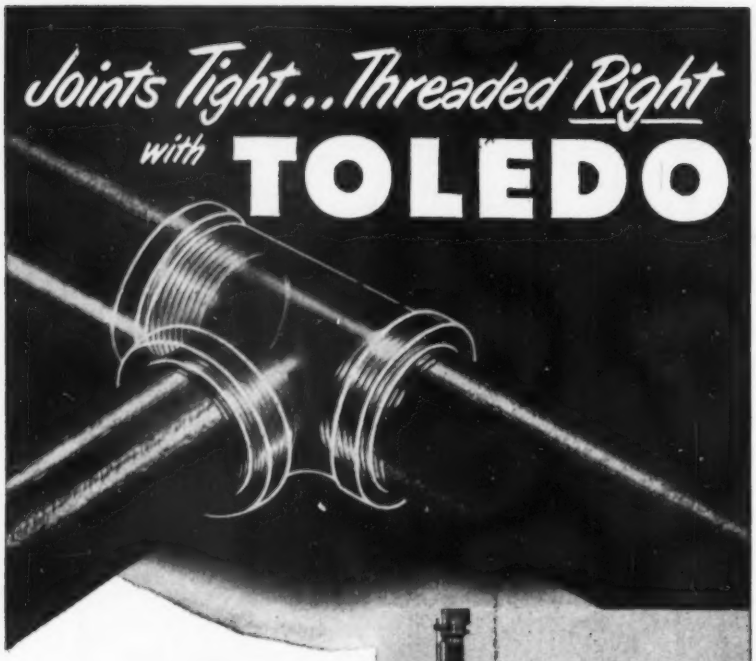

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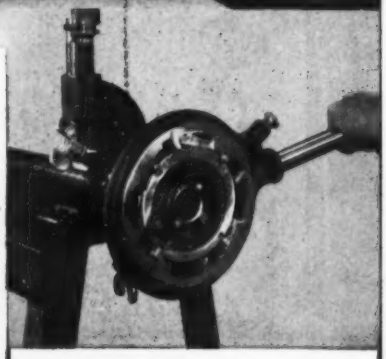

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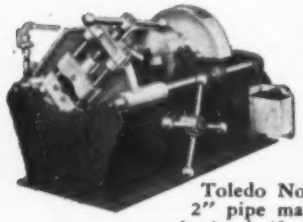

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have had calls from these people telling us they have received shocks from these units. Is it mandatory to ground these conditioners when they are in locations which may be within easy reach of grounded surfaces?—F.C.

A. In section 2545c, grounding of all exposed metal parts of portable appliances in residences is NOT required when

a. used in damp or wet locations, or
b. used by persons standing on
   1. the ground, or
   2. metals floors, or
   3. the insides of metal tanks or boilers.

So in general there is no mandatory rule for grounding these portable window air conditioning units.

The entire question of grounding portable equipment in residences was quite thoroughly studied by a special committee of the old Electrical Committee of the NFPA. A copy of this excellent report may be obtained from IAEI headquarters in Chicago.

Briefly this report concludes that for the present the disadvantages far outweigh the advantages of having full grounding requirements for portables in residences. To illustrate one of the difficulties which would be encountered, suppose all such units were required by code to have a three wire cord and plug, one wire and plug terminal arranged to ground the portable unit. If this unit were purchased by someone who planned to install it himself in his residence which is equipped throughout with standard two terminal receptacles, he is in a quandary as to just what to do, since in many such cases he has no definite knowledge about wiring matters. So in all probability he solves the problem by purchasing a standard two terminal plug, cuts off the three terminal grounding plug and plays around until somehow he gets two wires of the three wire cord attached to the plug. Or maybe he gets really enterprising and somehow or other decides to tie two wires under one screw and the third wire under the second terminal. Thus it is quite possible to have the "hot leg" tied in directly to the metal casing of the air conditioning unit.

Even in those cases where an approved three wire grounded installation has been originally installed by a competent electrician there may be trouble. At some later date the plug may have to be replaced, and rather than call in a certified mechanic, "Mr. Fix-it" decided he knows all about such things. "Really this job is so simple it is ridiculous." Three wires, three screws, simple, nothing to it. Well he may hit it right and then

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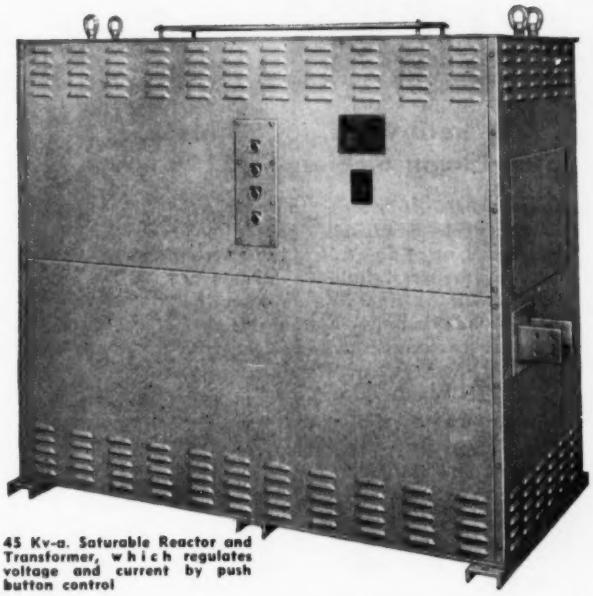

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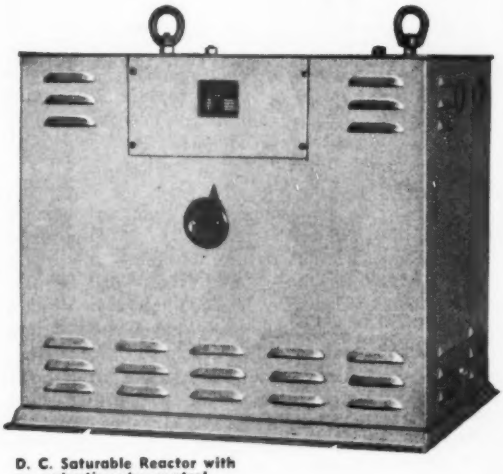

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again the hot leg may be fed to the metal casing of the unit.

So the grounding of any residential portable unit is a problem. If it is found that the units will give a shock then there may be several ways that this may be eliminated.

First of all reverse the plug in the receptacle. Many times this will eliminate the "live" case.

Running a separate grounding conductor to a nearby water pipe will also give adequate protection. By installing this separate grounding conductor and extending it so that it does not tie in with the portable cord, in many cases calls attention to the fact that this is some special wire.

Of course, in such cases when the competent mechanic is originally called in he can do a very fine job of education by spending just a few minutes with the user and explaining to him the importance of having any future work done by competent electricians. The manufacturer may also help by placing some sort of printed warning within the unit.

The 1953 Code is taking some steps to resolve some of the difficulties of this problem. Regardless of Code rules and requirements set up it is still a long range program of education, not only of the public but of the varied personnel of the Electrical Industry. —B.Z.S.

Outlet Boxes for Grain Elevator

Q. *Does the Code now prohibit the use of a conventional outlet box in a country grain elevator when a bonding jumper is used from conduit to conduit around the box and the box contains only properly taped splices?*—K.M.

A. Yes, the Code no longer accepts the use of an ordinary outlet box in a Class II Division 1 location as Section 5054 now reads that fittings and boxes shall be provided with threaded bosses for conduit connection, shall have close fitting covers and shall have no openings (such as holes for attaching screws) through which sparks or burning material might escape. Inasmuch as the conventional outlet box not only has openings through which nails or screws may be used for supporting the box but in many cases also has openings for the insertion of a screw driver when removing knockouts, it becomes quite evident that the Code prohibits the use of a conventional outlet box even though a bonding jumper is placed around the box. This section does not

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forbid the use of conventional conduit fittings, however, except in Class II risks where the dusts are conductive and inasmuch as conductive dusts are not encountered in grain elevators, it is permissible to use conventional conduit fittings on conduits installed in Class II, Division 1 locations containing non-conductive dusts.—G.R.

Conduit in Air Duct

Q. *The city is remodeling a three story school building here and is installing domestic science classrooms on the third floor, making it necessary to run feeder conductors from the basement service equipment to these classrooms to supply the electric ranges which will be installed. As the building has brick walls and concrete floors, we would like, if possible, to run a vertical conduit in the cold air duct, which extends from the basement through to the third floor, with the distribution panel mounted on the outside of the masonry enclosure for this duct work. As the use of this return air duct would materially reduce the cost of running this feeder, we would like to be advised as to whether or not it would be a Code violation.*—M.H.

A. Section 3020 of the National Electrical Code provides permission to extend a rigid conduit run through a vertical duct of this type provided the raceway will not in any way interfere with the operation of automatic fire dampers in this duct. It might be well to call your attention to the fact that this section does not accept the use of electrical metallic tubing.

Welding Loads

Q. *30 kva welders, 10% duty. Can you explain? 3 = 220 volt, 10% duty requires a multiplier of .32 (6331 Paragraph A.)*

One welder 136 x .32 = 43.52

Next two welders 43.52 x 2 x .6 = 52.22

How do you arrive at these figures and what page in the National Electrical Code?—V.S.

A. The above question is in reference to computing a welding load which appeared in our November issue, under the heading "Common Code Problems", page 85. The computation was shown as follows:

3-single phase, 220 volt, 30 kva non automatic feed spot welders with a 10% duty cycle and having a total rating as follows:

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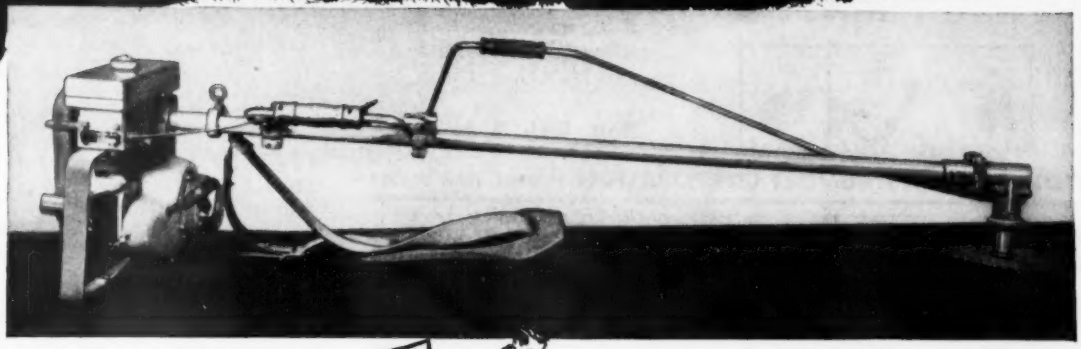

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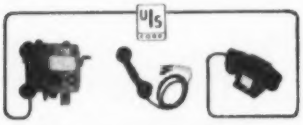

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(a) 30,000 ÷ 220 = 136 amps per welder (1 phase)

(b) 10% duty cycle requires a multiplier of .32 (6331, Paragraph A).

(c) 136 × .32 = 43.25 amps per welder. (1 phase)

(d) First welder 43.52 amps.
Next two welders 43.52 × 2 × .6 = 52.22 amps.

(e) 43.52 + 52.22 = 95.74 amps. (1 phase)

(f) For division among 3 phases, one welder per phase, 95.74 × .577 = 55.24 amps per phase (3 phase basis)

All of the Code rules involved with the computation appear on pages 272 and 273 of the N. E. Code, under Section 6331. Since the problem involves more than one welder, Section 6331-b applies. Reference to this Section however shows that the current for the largest welder, which has a specific operation, is computed as required by Section 6331-a-2 which is clarified by Section 6331-c. As shown in the problem (a) above the largest welder is 30 kva, and the rated primary current of this welder is 30 × 1000 ÷ 220 volts = 136 amps. Since this welder operates on a 10% duty cycle, this value is decreased by multiplying by .32 which results in 136 × .32 = 43.25 amps. (Table in Section 6331 A-2). This takes care of the first welder. The next two welders are figured on the basis of 43.25 amps per welder, subject to a 60% discount (Section 6331 b) 43.52 × 2 × .6 = 52.22 amps.

A summary of the foregoing, results in a total load of the 3 welders =

Largest welder	43.52 amps
Next 2 welders (26 amps. each)	52.22 amps
Total welder load	95.74 amps

This total load is divided over the three phases, one welder per phase, as shown in the Article in our November issue. There is no Code rule on this computation. The line currents shown are computed in accord with formula governing the characteristics of 3 phase, delta, alternating current systems.—B.A.McD.

Official N. E. C. Interpretations

INTERPRETATION NO. 389

(Issued January 6, 1953)

SECTION 3362—Installation of Non-Metallic Sheathed Cable in Concrete Raceways.

Question: With respect to Section 3362 of the 1951 edition of the National Electrical Code, may non-metallic sheathed cable be run or fished in concrete raceways built in brick walls or concrete floor slabs not exposed to excessive moisture or dampness.

Answer: Yes.

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Hinged FOTA-LITE glass bottom has louvers photographically reproduced through the entire thickness of the glass to assure accurate cutoff and low fixture brightness.

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Yet, you can easily see how the architects, lighting engineers and fixture manufacturer have provided highly functional lighting and made a beautiful installation, too. They used a selection of CORNING FOTA-LITE and ALBA-LITE shielded fluorescent and incandescent luminaires.

Using these units in various design layouts affords high level, quality lighting for 22,800 sq. ft. of floor space. And the architectural flexibility of the glassware complements the design of the installation itself.

Give your customers *all* the benefits of high-efficiency lighting with low fixture brightness and modern styling by specifying CORNING engineered lighting glassware. The coupon will bring you full details of the many sizes and shapes available.

Front lobby also has FOTA-LITE in troffers and highly heat-resistant PYREX brand LENSLITES in recessed boxes for control of incandescent light sources.

Soft over-all lighting effect in hallways is obtained by using PYREX brand LENSLITES with wide-angle lens in recessed ceiling boxes.

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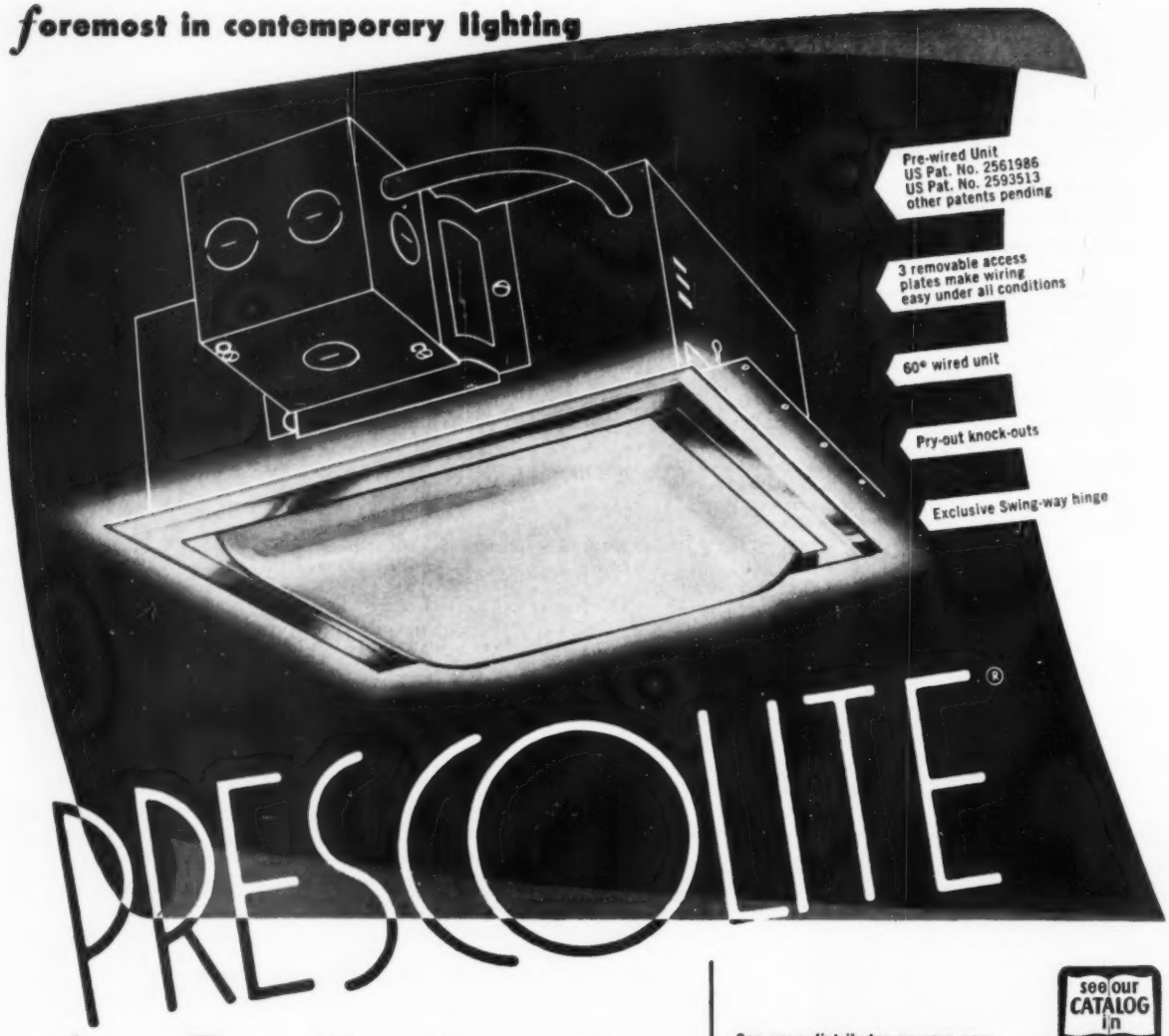

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Modern Lighting

Luminous Ceiling Lights Ticket Sales

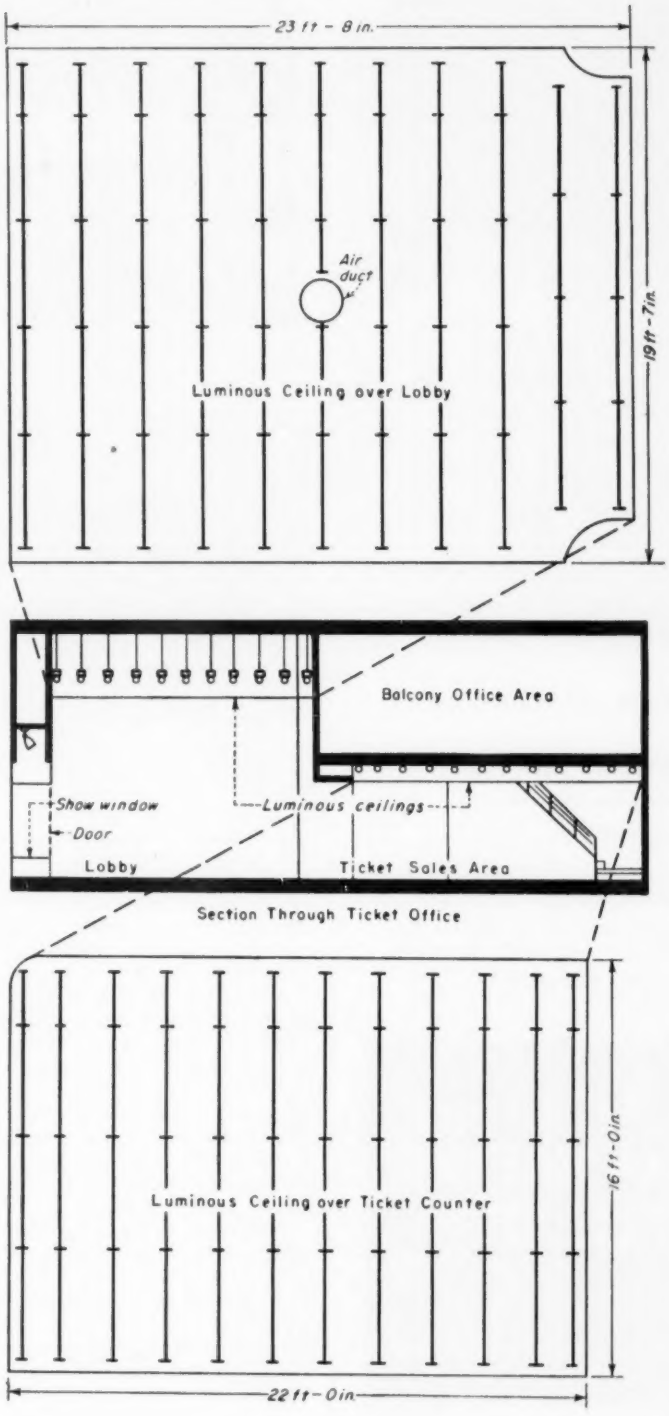
American Airlines adopts luminous ceiling lighting for ticket offices, makes first installation in Radio City office, New York.

LUMINOUS ceilings serve two purposes in the recently remodeled ticket office of American Airlines, Inc., located in Rockefeller Center, New York City. They provide an artistic, decorative treatment, and plenty of well-diffused, shadowless illumination—both conducive to pleasant purchasing of top-flight transportation.

This street level ticket office occupies approximately 1150 square feet of floor space, including the main floor area and balcony. The front part of the main floor is a reception area, over which a wall-to-wall luminous ceiling is suspended 14 feet from the floor. The rear portion of the office has a 7-ft. 6-in. ceiling height in which a luminous ceiling panel extends over most of the floor area including the ticket sales counter and work space. General office space is provided on the second floor balcony area which is closed in over the rear part of the ticket office.

The lighting design is based on a high level of illumination in the rear part of the office over the ticket counter and work area, and a lower intensity of lighting in the lobby, or reception area. This feature attracts the attention of waiting customers, and even of the passersby on the street, to the activities at the ticket counter. This leaves the reception area in a restful and subdued atmosphere. A colorful mural covers the wall area facing the ticket counter, while the opposite wall, rear wall and two side walls in the reception area are finished in a rich, soft old rose color. Self-lighted wall displays and racks of folders and travel literature are displayed along the two side walls of the reception area.

The luminous ceilings consist of continuous panels of corrugated vinyl plastic supported on T-bars, above



PLANS show lamp layouts over luminous ceilings, and section shows relation of lamps to ceiling and cavity opening.

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LUMINOUS CEILINGS light ticket counter and reception lobby effectively and artistically in American Airline's Radio City ticket office, New York City.

AIR OUTLET in lobby ceiling fits snugly in opening cut in corrugated plastic panels.

which are continuous rows of standard pre-heat cool white fluorescent lamps mounted on wireway channels, or lighting strips. The entire plenum above the plastic ceiling is painted flat white with a high reflection factor, about 78%.

A total of 43 40-watt lamps and 10 20-watt lamps are used over the lobby area, supported 18 inches above the plastic panels. The plenum ceiling in this area is 5 feet above the suspended plastic ceiling. Total area here is 480 square feet, resulting in a load of 4.8 watts per square foot. The average intensity in the reception area is 56 footcandles.

The plenum cavity at the rear of the office is only 14 inches deep, and contains a total of 36 40-watt lamps and 12 20-watt lamps. The lighting strips are mounted directly to the ceiling slab. The area in this portion of the office is 440 square feet, resulting in a load of 4.6 watts per square foot. Average intensity is over 100 footcandles on the ticket counter. The higher coefficient of utilization for this area is accounted for by the relatively shallow cavity above the plastic ceiling, and by the exceedingly low ceiling height.

The entire ticket office is air conditioned. A large center air outlet is located in the lobby ceiling, with the plastic panels cut and fitted around it. The plastic ceiling is also cut and fitted to a half round column on each side wall at the rear of the lobby area.

Because of the beauty and efficiency of this installation, plus its relatively low cost for the quality of the resulting lighting effect, American Airlines has already installed a second job in a ticket office in Washington, D. C.

The plastic panels, supports and lighting channels were supplied by Luminous Ceilings, Inc., Chicago. Wiring and installation of the entire job was done by the Johnson Electric Corporation, electrical contractors in New York City.

Unique Design Features In Underground Rampway

Due to terrain, utilitarian design and a railroad spur running along the front of Lincoln Electric's modern new plant in Euclid, Ohio, the entrance to this recently-completed building is through a separate structure located some distance in front of the main plant. This separate building is distinguished by a long covered passenger-loading platform and an impressive all-glass central entrance through which one passes to descend a wide double stairway.

Years Ahead **IN DESIGN**

Wheeler FLO-LINER

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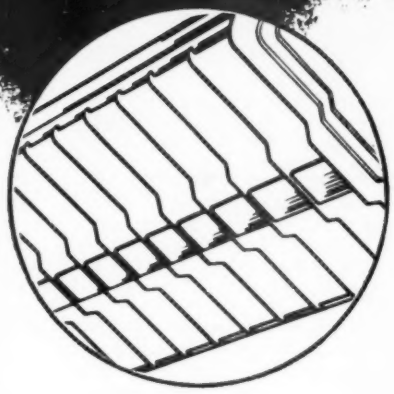
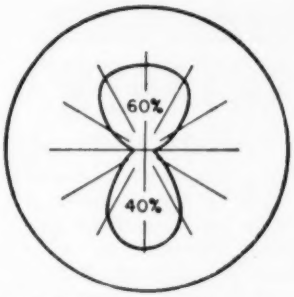


Tomorrow's fixture *today* — the new Wheeler FLO-LINER combines high efficiency and smart styling with unique maintenance ease and economy. When detached, louver assembly is automatically suspended below channel by supporting chains — allows quick, easy access to operating equipment. Amazingly flexible — 2 lamp and 4 lamp units available for both single pin and bi-pin lamps!



45° CROSSWISE SHIELDING — provided by the unique use of a plastic center panel which gives comfortable shielding to this shallow, smartly styled unit.

85% EFFICIENCY — translucent plastic side panels and center panel give low brightness for more comfortable seeing and high efficiency. For further seeing comfort, 51% of the light is directed above the horizontal and 34% below.

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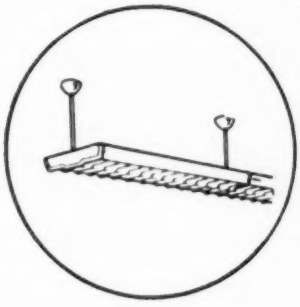

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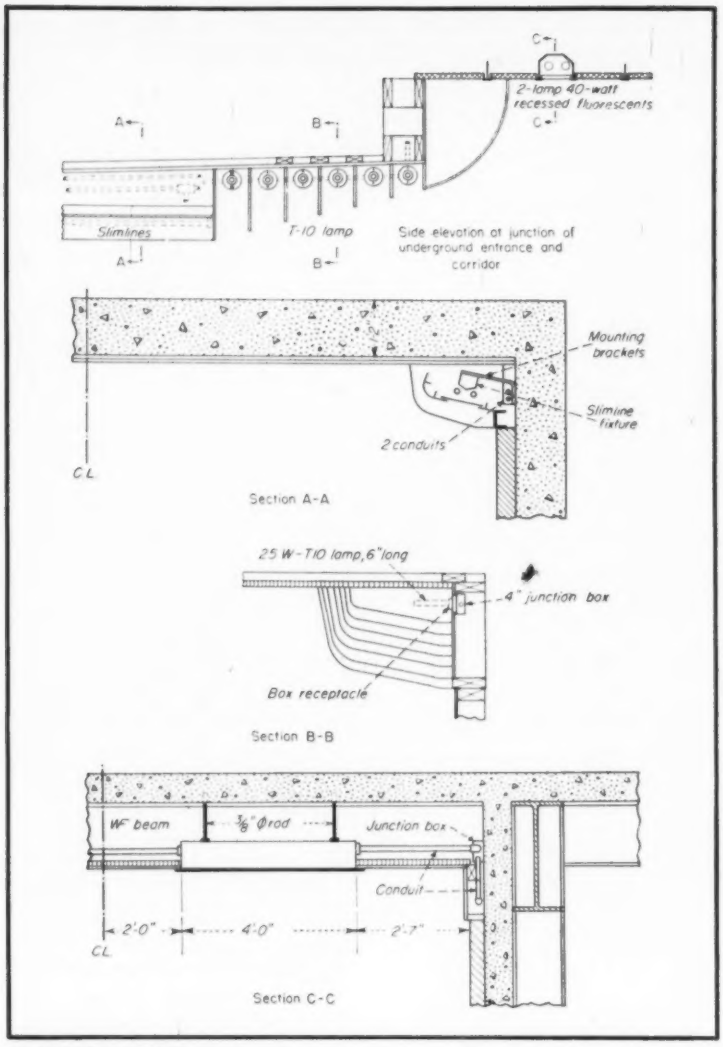

ENTRANCE TUNNEL is primarily illuminated by continuous double row of shielded and baffled slimline lamps along the tops of side walls (A-A). Intersection with underground office lobby is lighted by series of horizontal T-10 lamps at right angles to the walls and separated by metal fins (B-B). Office lobby is top lighted by recessed 2-lamp fluorescent fixtures (C-C).

from the foot of which a corridor extends beneath the railroad tracks to the actual entrances to office lobby cafeteria, conference rooms, welding school and the factory service corridor running beneath the plant.

Lighting in this underground brick-walled entrance tunnel is unique, for it combines three distinct treatments. The main tunnel is lighted by two continuous rows of slimline lamps mounted at the intersection of each wall with the roof, and lamps are alternately wired between four circuits to provide continuity of lighting and flexibility of control (A-A). Diffusing glass panels and large baffles at fixture junctions reduce excess brightness in the line of travel.

When the tunnel enters the higher-ceilinged office lobby, lighting changes from the surface-mounted longitudinal installation to a transverse ceiling-recessed plan (C-C). And, at the point where these two systems meet, a series of vari-sized fins extend outward from the wall at right angles to shield groups of 25-watt T-10 lamps supported by box receptacles set flush with upper wall surfaces (B-B).

Diffuse Lighting In Drafting Room

An installation of surface-mounted fluorescent fixtures today affords high level, diffuse, shadow-free lighting in the drafting room of the new Acme Brick Company building, Fort Worth, Texas. The quality of the lighting in this area is typical of the lighting re-

Unretouched photograph of the Quincy School, Dedham, Mass. Electrical Contractor: Robert L. Tibbetts, Dedham. Area: 804.5 square feet. Fixture Mounting Height: 10'-0". Fixture spacing: 10'-0". Fixtures: 9- No. 6628 pendant mounted, with 2-T1296 Standard Warm White Slimline lamps each. Watts per fixture: 177. Watts per square foot: 1.98. Room Finish: Cream yellow upper walls; olive green paint on chalkboards, using yellow chalk; dark varnished woodwork; scrubbed pine floors @ approx. 20% reflection factor. Readings at desk level: (20"-21" from floor), Average, 51.7 Footcandles initially. Vertical Readings on chalkboards: 28 Footcandles average.

The "LIGHT" Touch is the Right Touch to get Brighter Students

IF seeing's believing, using's proof with these smart LITECONTROL Slimline fixtures. Ask the pupils who do their *seeing* in this schoolroom, now that it's relighted by LITECONTROL. Light but not bright, they find it's easier to see and see-through the tough ones.

Note the high level of lighting throughout the room—the even illumination of the chalkboards — the well-lighted ceiling with only moderate contrast — the unusually good end-throw from the unit.

Ask the electrical contractor, too. He'll point out the simple installation ...low initial cost... and high efficiency (86%). Baffles are hinged from either side, may be installed or removed without use of tools.

Another example of the "More Light and Looks for Your Money" you get with *every* LITECONTROL fixture.

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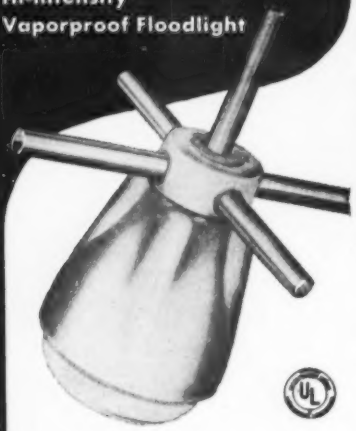

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VR300X has a heat resisting screw type front lens (as shown below). The junction box may be hung pendant, or ceiling mounted as an X type fitting. Plugs are provided for the unused ½" IPS Threaded opening.

The VR300X is the ideal floodlight for factories, loading platforms, storage yards, docks or warehouses.

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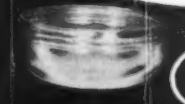

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DIFFUSE LIGHTING in this drafting room is the result of rows of 4-lamp fluorescent units shielded by Fota-Lite and Alba-Lite diffusing glasses.

sults obtained throughout the entire 4-story building, which was wired by the Empire Electric Company, electrical contractors of Fort Worth.

The fixtures are surface mounted in three continuous rows along the acoustical tile ceiling, with six units in each row. Each unit is 48-inches long, 13-inches wide and 5-inches deep, and is equipped with four pre-heat type 40-watt F lamps and high power factor ballasts. Diffusing glass shielding consists of Alba-Lite side panels and Fota-Lite panels in the bottom frames of the fixtures. The bottom frame of each fixture is hinged for handy lamp replacement and is retained in the closed position by thumb-screws. The fixtures were designed and manufactured by Gruber Lighting, Brooklyn, N. Y.

The lighting results in this drafting room are particularly suited to the visual tasks pursued. The light level is approximately 50 foot-candles of general illumination, without benefit of local lighting. Due to the fullness of the fixture shielding, the comfort level is also high. The downward component is diffuse, eliminating severe shadows in the normal field of vision; and the fixture side panels allow light spill on the ceiling to relieve harsh contrasts. The color and finishes of the interior surfaces and furnishings were selected to keep brightness ratios well within recommended ranges.

OFFICIAL FAMILY of the Electric Motor Service Association (Central District Chapter, NISA) in Chicago include: (L to R) NISA director—J. F. Ferrari, Excel Electric Service Co.; vice president—Fred H. Westphal & Co., Janesville, Wis.; president—Glen Glave, Chicago Electric Co.; secretary—Paul M. Martin, Northwestern Electric Co.; treasurer—H. W. Reeve, Inland Industrial Electric Service Co.

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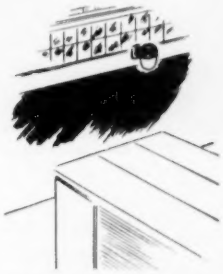

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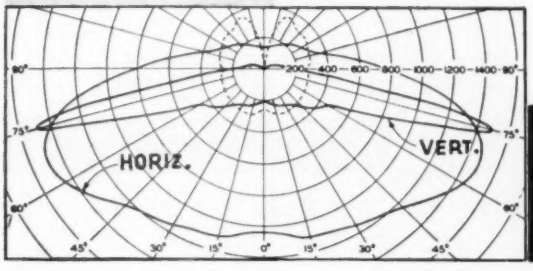

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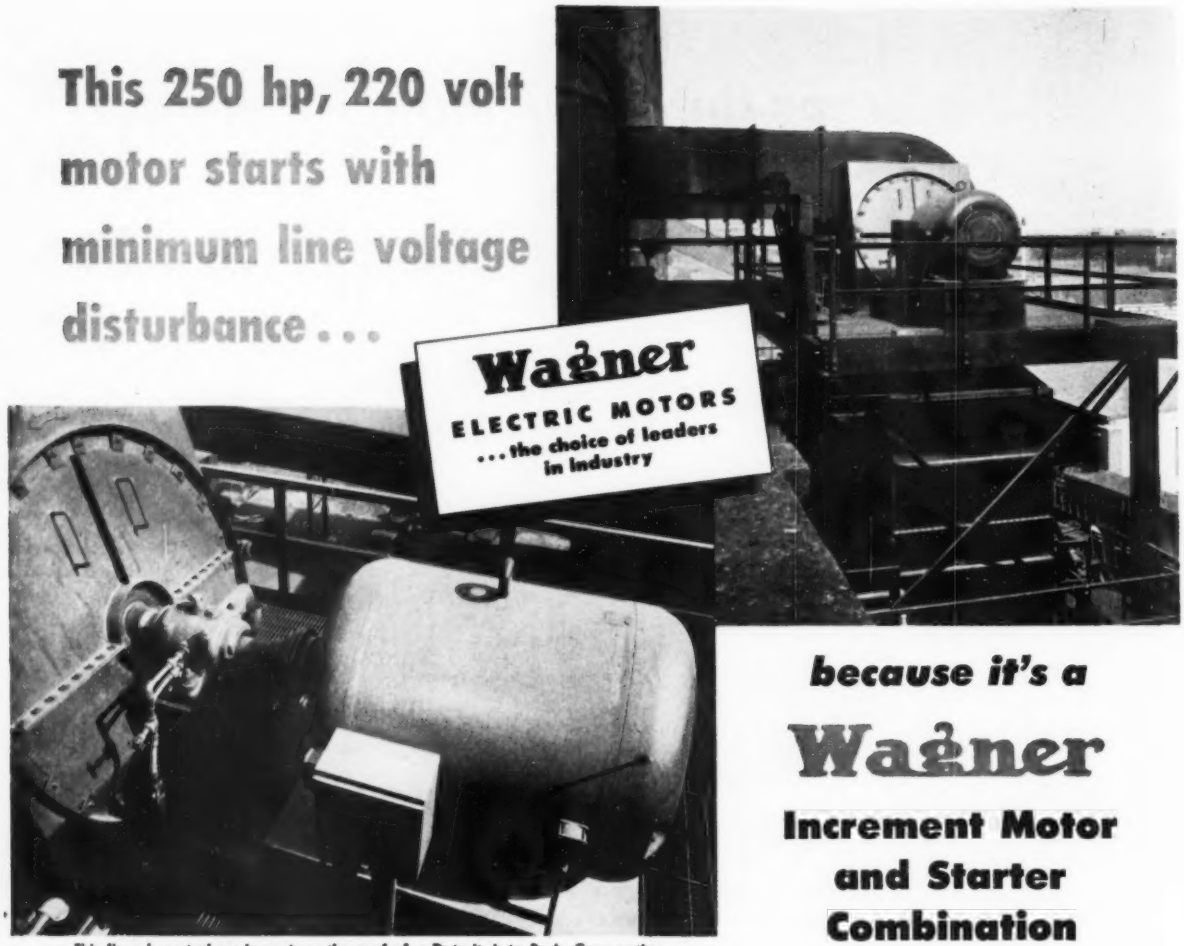

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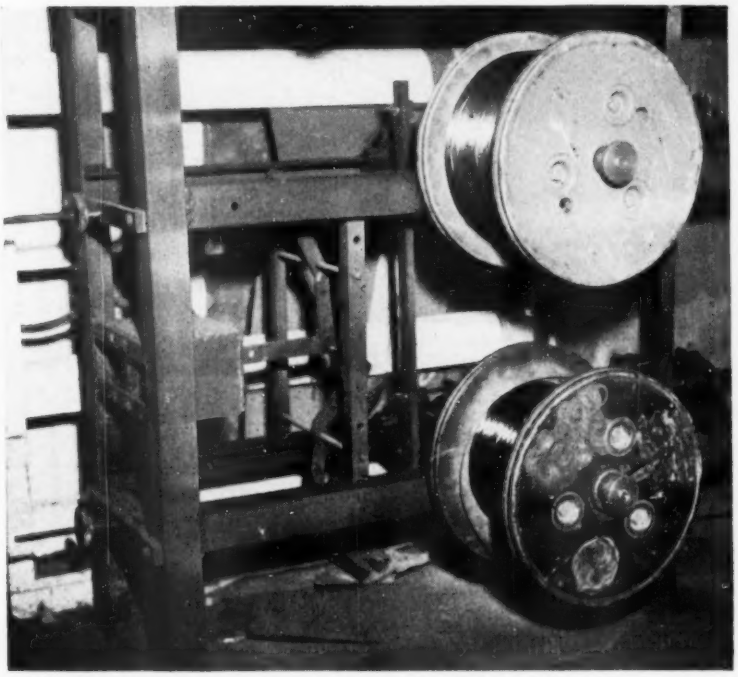


UNDER TENSION, wire can frequently drag or bind during coil winding operations. Without friction, however, reels can spin freely and snarl the wire. Here is a device for effectively applying or releasing spool brakes at will, with the remote control conveniently located at the winding stand. Brake operation is discontinued by solenoid action.

Solenoid Releases Brake On Reel Tension Device

To keep wire spools from spinning freely, thereby permitting wire to become slack, kinked or tangled during coil-winding operations, tension devices are normally installed at a point in the wire travel, and also directly to the reels. This created friction sometimes is greater than desired, however, and time is wasted while the amount of tension is regulated.

In the shop of Walter J. Rider, Binghamton, N. Y., this tension is momentarily released by a solenoid-operated brake, the control for which is located adjacent to the winding machine convenient to the operator. Therefore, without having to leave his position at the winding machine, the winder can release the friction at the reel whenever less tension on the wire is desired.

Reels are supported on spindles mounted to a channel iron frame, and the solenoid and braking mechanism are so positioned that they can control the friction on four spindles simultaneously.

Work Control Board Aids Shop Operation

There's no shuffling through a sheaf of papers or work orders to check the status of repair jobs in the Torrence Electric Company shop at Rock Island, Illinois. Shop foremen can check the number of jobs in the shop when they come in, by merely consulting a large Work Control Board designed by R. F. Van Hoorebeke, secretary-treasurer of the company.

The large board is in full view of everyone on the shop side of a wall partition separating the repair department from the office area. It covers a month's operations and is divided into five colored sections according to the following code:

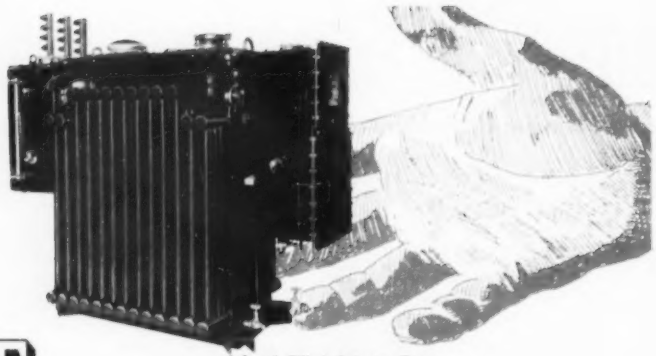
Red—left side—Rush jobs

White —4th week
Green —3rd week
Yellow —2nd week
Blue—right side—1st week

Each colored panel is 30½ inches wide and 48 inches high and contains some 72 hooks. The red "rush" panel on the left is only 7 inches wide and has 16 hooks. Each hook has a set of numbered indestructible brass tags which are fastened to the repair job when it goes through the shop. Tags are numbered consecutively from left to right starting at the upper left hand corner of the board. All tags are replaced on the hook from which they are taken, so the shop foreman always can tell by tag number on what section of the control board the job is posted.

Briefly, the system works like this. Jobs coming into the shop during the first week of the month get tags from the blue panel at the right side of the control board. Those coming into the shop during the second week are tagged from the yellow panel and so

COLOR-CODED WORK CONTROL board has panels for each week of the month plus a special section for rush work. A glance at the job tickets tells the foreman how many jobs came in during a specific week and facilitates follow-up.



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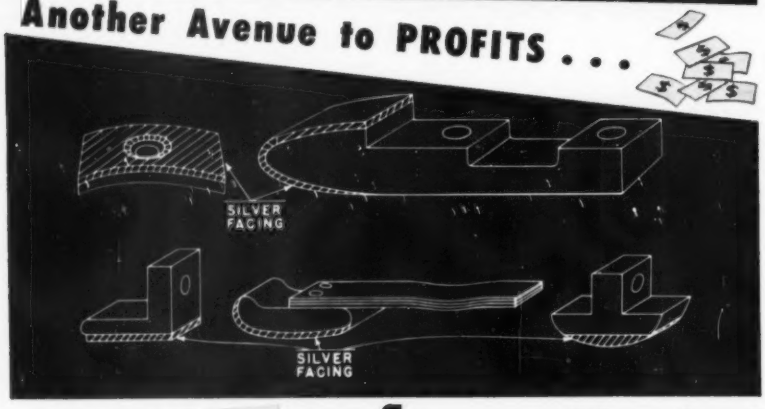

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Worn silver contacts start their lives all over again when re-faced by the Superior factory method. *Cost?* Compares favorably with that of a new contact. *Service?* Longer than the original copper contact. A bargain for your customer, and more business for you!

SUPERIOR CARBON PRODUCTS, INC.
9114 George Avenue • Cleveland 5, Ohio

Ask for new Catalog "C-3".

Since 1919 Superior CARBON BRUSHES

on. Rush jobs (usually overnight work) are tagged from the red panel at the left of the board.

When a motor comes into the shop, a job ticket and master work record are made out. Both contain the tag number from the proper panel on the control board. The job ticket remains on the control board hook until the motor repair is completed. The brass tags are attached to the motor and its parts and stay with it throughout the repair process. Also noted on the job ticket is a print number referring to a glassine-protected connection print in the shop files. The master work record remains in the office and is filled in with complete data from the job ticket when the job is ready for delivery.

Each Monday morning, the shop foreman checks the control board startting at the blue (first week) panel at the right. If too many tickets remain on the panel too long, he begins tracing the jobs to find out the reason for the delay. Even during his inspection of the shop operations, he can spot when a motor came in for repair by the number on its brass tag.

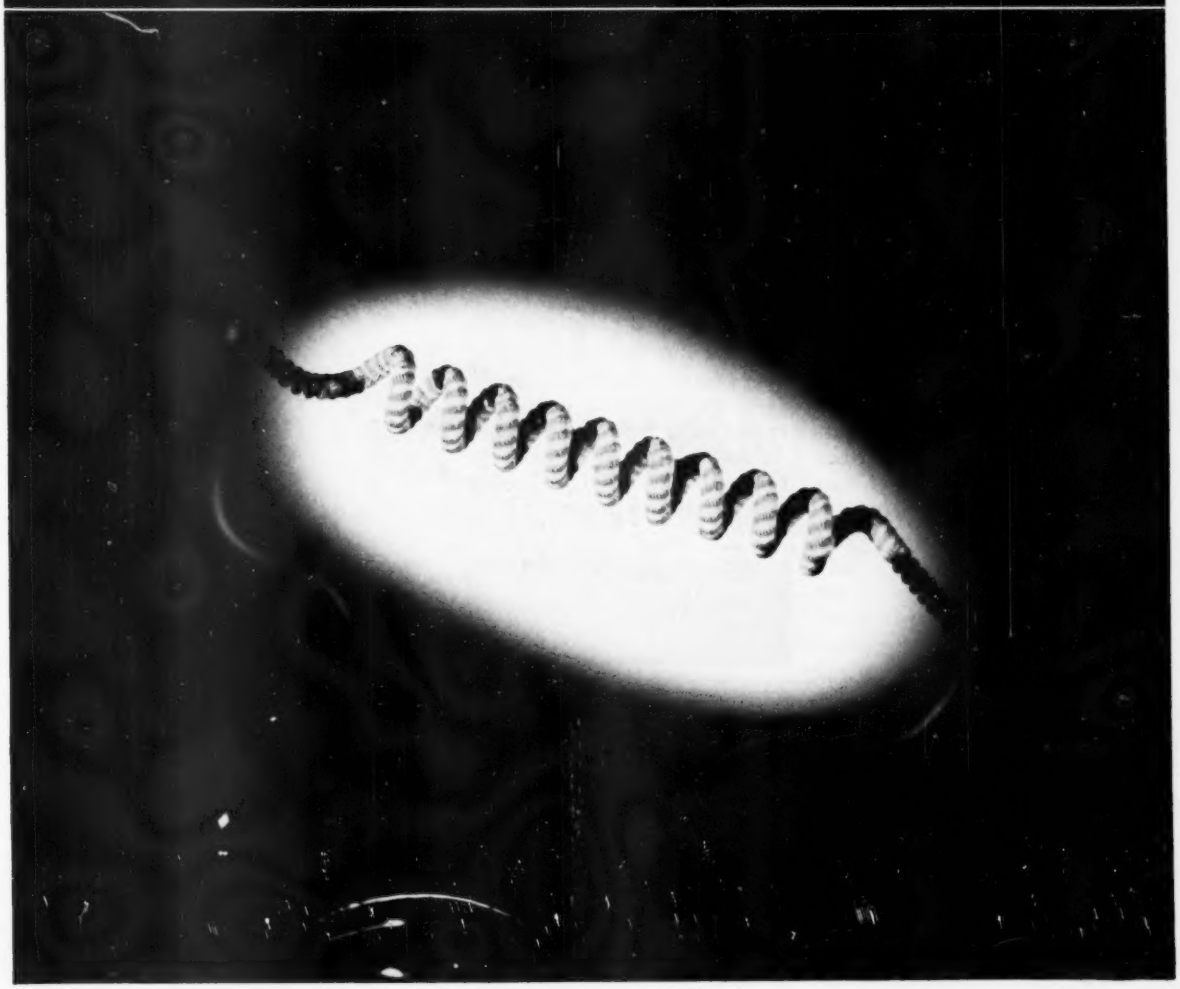
Van Hoorebeke finds this type of work control board does much to provide a better follow-up on jobs in process and feels it can be used as an efficient tool for shop mangement. In effect, it gives the total shop score at a glance.

Bearing Stethoscope

Management at the Johnson-Turner Electric Repair and Engineering Co., Ltd., Windsor, Ontario, Canada, insists that every piece of electrical

LISTENING IN with stethoscope on a bearing of a motor under test. Note rod (arrow) from telephone receiver case to bearing housing.

You expect the best value from G-E fluorescent lamps



Extra twist squeezes more light from G-E slimline lamps

The electron flow that lights a fluorescent lamp is started by a special chemical mix held on tungsten filaments at each end of the lamp. How long the lamp lasts depends in part on how long the chemical clings to the filament. In most lamps, the filament is twisted into a double coil, to hold a quantity of the mix in a firm grip.

General Electric goes a step further by giving the double coil a third twist — making a triple coil. Used in G-E slimline and other G-E instant-start lamps, the triple coil holds more mix, and holds it more firmly. It gives you extra light for your money because it makes the lamps last longer. This is another example of why you can expect the best value from G-E fluorescent lamps.

You can put your confidence in—

GENERAL ELECTRIC

Prevent Costly Burnouts

with

VAP-OIL-TITE FITTINGS

Fouled contacts cause costly burnouts and down-time. Use VAP-OIL-TITE FITTINGS with Plastic Covered Flexible Metallic Conduit for Sure Sealing of wiring on oil, water, dust and vapor tite equipment.

VAP-OIL-TITE'S exclusive threaded bushing not only insures positive grounding but also makes fitting easier to install because a collar covers metal edges making burring unnecessary. Furnished in numerous types with body sizes from 3/8" to 2". Write or wire today for bulletin #MT-104 giving types, sizes and prices.

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3600 Palomar Ave., Chicago 51, Illinois
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WANT the BETTER* TRANSFORMERS?

Open

We build them . . . with modern materials and engineering techniques . . . plus up-to-date design . . . based on years of experience.

Closed

Here is a typical air-cooled 500 KVA class B type. 80°C Rise. 3 phase 4160 Delta Primary + 2½% full capacity taps. 240x480 Delta Secondary. Available from 30 to 2500 KVA with voltages from 2400 to 15 KV.

DISTRIBUTION TRANSFORMERS (DRY TYPE)

DRY TYPE
Indoor or Outdoor
3 KVA to 15 KVA
Air-Cooled

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TRANSFORMERS AND ELECTRICAL EQUIPMENT
WALTER GARLICK, JR., PRESIDENT
246 SCHUYLER AVE., KEARNY, NEW JERSEY

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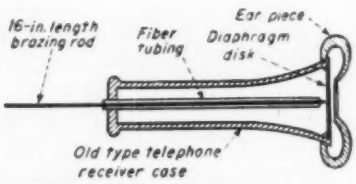


CROSS-SECTION OF stethoscope showing simple design. Note sound insulating sleeve on rod where it goes through receiver case to diaphragm disc.

equipment be thoroughly checked and tested before it leaves the repair shop. This policy is strictly followed even if the repair consists of only a motor bearing replacement.

One simple test device used on all motors is a "bearing stethoscope", so designated because it permits test personnel to listen to bearings while the motor is running. The unit is made from an old-style telephone receiver and a 16-inch length of brazing rod. All of the receiver mechanism except the diaphragm plate is removed. The brazing rod is welded to the mid-point of the disc (at right angles) and passed through the opening at the base of the receiver case (where the cord normally would be). The diaphragm is centered and held in place by the receiver ear-piece. Where the rod passes through the receiver, it is insulated from the case by a length of fiber tubing. The result is an instrument which will transmit sound vibrations from the end of the rod to the ear-piece diaphragm and then, in amplified fashion, to the human ear.

To use the instrument, the mechanic merely places the end of the rod on the motor bearing enclosure and holds the receiver to his ear. Men with an "experienced" ear can readily uncover bearing trouble that normally would escape detection. A high-pitched whistle in the stethoscope would mean a dry bearing; a thumping noise, even if slight, might mean a flat ball; a grinding noise, possible dirt or foreign matter in the bearing.

While arrangements were being made to take the accompanying photograph in the shop, a bad bearing was detected by this "stethoscope" on a motor ready to be delivered. A replacement was made in a matter of minutes and a costly call-back and possible dissatisfied customer were averted.

Slanting, Grooved Shelves Hold Tools Safely, Visibly

Reamers and drills, used in the motor repair shop of Charles Buckley, Atlantic City, N. J., are stored conveniently, safely and visibly in a special bin designed for this purpose. The

LABELED SHELVES with slotted divisions provide safe storage for reamers and drills. Cutting edges are protected against inadvertent nicks, and slanting arrangement makes selection or inventory an easy assignment.

bin has grooved, slanting shelves to hold the various items, and each slot is labeled to identify the tool contained and its size. Employees replace tools immediately after use so that misplacement becomes unlikely and duplication of tools is unnecessary.

Electric Chisel Cuts Coil Ends

Removing defective coils from their slots prior to rewinding is facilitated by using both electric and pneumatic chisels in the shop of the Warwood Armature Repair Company, Wheeling, W. Va. After the insulation has been roasted to remove the resinous binder, one end of each coil is sheared as noted, and the other end is gripped with tongs and pulled loose. The routine of roasting, cutting and pulling usually results in a clean coil slot with minimum effort.

SHEARING of coil ends with an electric or pneumatic chisel facilitates removal of damaged coils from motors being repaired in the Warwood Armature shop.

AVOID SHUTDOWNS!

QUICK! FIND GROUNDS ON ENERGIZED POWER CIRCUITS

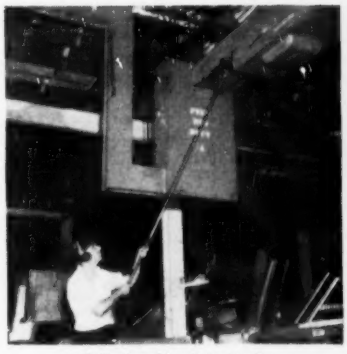
WITH THE BRUNT FAULTFINDER

One man can quickly locate grounds on energized power circuits during normal operation — without shutdowns. This compact instrument locates faults on ungrounded wiring systems, up to 550 volts, a.c. or d.c.

Among its numerous advantages:

- combination Ground Detector and Fault Locator
- locates grounds on energized lines
- no delicate meters or instruments to adjust
- one man operation
- small, compact, easily installed
- equally strong signal on open or enclosed wiring
- can be used in dark or noisy locations
- traces pole line signals, without climbing
- phase indicator lights can be seen at a distance
- fully guaranteed

Tracing Signal To Panel.



Following Signal In Duct

Parr ELECTRIC CO. INC.

SEND COUPON NOW

Parr Electric Co., Inc., 40 Austin St., Newark 5, N. J.
Send me at once without obligation complete details on BRUNT FAULTFINDER.

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Position .....

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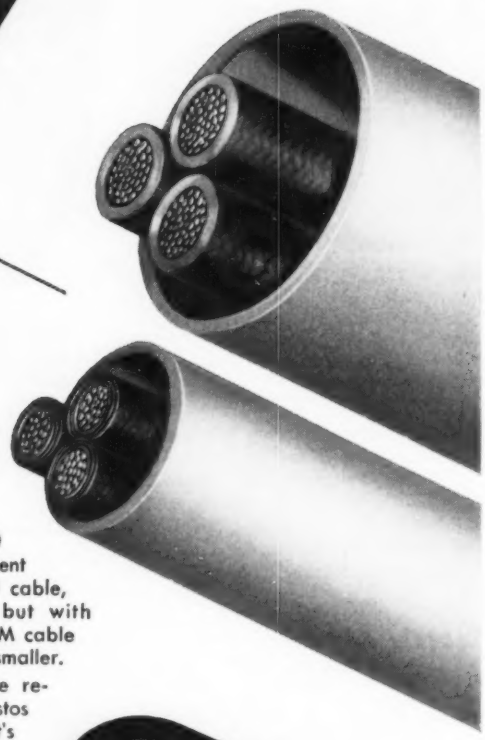
LOAD FOR LOAD!



ROCKBESTOS AVA

COSTS LESS INSTALLED

For example, take a 430 ampere load at 40°C Ambient temperature. To use type RH cable, an 800 MCM is required but with Rockbestos AVA, a size 500 MCM cable carries the same load and is 38% smaller.

Three 800 MCM type RH cable requires a 4" conduit, while with Rockbestos AVA, a 3" conduit does the job. What's more, the quicker, easier handling of lighter-weight Rockbestos AVA reduces labor costs substantially.

Compared size for size, Rockbestos AVA (AVC) helps you increase capacity simply by rewiring old conduits. No new larger conduit, fittings and accompanying labor are needed.

All because Rockbestos AVA (AVC) insulation's dielectric strength is *so well protected* it takes less to do the job . . . and assure maximum dependability through the years. Write for booklet "Cut Current Carrying Costs".

It's the A.V.C. "Sandwich" that makes the difference.

Inner Felted Asbestos Wall
Varnished Cambric
Outer Felted Asbestos Wall
This "sandwich" protects the varnish cambric. It enables A.V.A. to carry more current than cables with conventional insulations.

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...Your best buy

In The News

Utah Group Sees Good Year Ahead

More than 150 members of the electrical industry in Utah and Idaho took a day's respite from their busy schedules to attend the annual conference of the Intermountain Electrical Association held at the Hotel Ben Lomond, Ogden, Utah, on January 21. During the conference sessions they took a good look at the future; liked what they saw; resolved to return home and make 1953 the best year yet.

A general spirit of industry confidence and anticipated business improvement permeated the meeting. Gratifying progress during the past year was reported by James C. Littlefield, retiring I.E.A. president and manager of the Salt Lake Division, Utah Power & Light Company. A 17.5% increase in membership boosted the Association roster to 275 industry representatives. On a basis of dollar volume of business, this covers about 75% of the electrical industry in the intermountain area, he noted. Littlefield cited the strong local chapter activities, group insurance and association merchandising promotions as being responsible for this gain. He warned those present that the future will bring keen competition for the consumer dollar; that a combination of industry cooperation and a return to the basic fundamentals of selling will be necessary to meet merchandising problems.

The use of persuasion as a basic fundamental of sales technique was outlined by Dr. O. Preston Robinson, former professor of retailing at New York University and present general manager of Salt Lake City's leading newspaper, the Desert News and Telegram. The power of persuasion is needed whenever a new idea conflicts with an old belief. Doubts must be overcome before new convictions can be made, he cautioned. To induce others—the customer, for example—to accept your point of view, first learn what the old beliefs are. Then harmonize the new ideas with these old beliefs. Use proof and evidence to bolster your sales presentation. Be sure to moderate your claims. Use logical reasoning to get a prospect to commit himself. Above all, avoid controversy in your selling, Dr. Robinson advised.

An educational program to teach prospects the advantages of food freezers and specifically how to prepare food for freezing can do much to spur food freezer sales, Marvell Mills, Marvell's Food Freezer Store, Salt Lake City, told the group. Encourage freezer sales promotions during the slow summer months and solicit complete industry cooperation, she advised.

The legal limits of an association's activities were discussed by George L. Nelson, Salt Lake City attorney. He pointed out that abuses of good business practice will increase as competition becomes sharper, but cautioned that an association legally could do little more than conduct an educational campaign on the advantages of ethical business conduct; or take legal action against untruthful advertising tactics. Publication of an approved (white list) dealer list or unethical dealer blacklist is illegal, he warned. You can act individually, but cannot conspire as a group to take any action that would even imply threat of business injury or restraint of trade, he stated. His advice to associations: stay close to competent legal counsel.

A Bright Future

Anticipated markets for appliances, electrical equipment, electrical energy and construction activities indicate that 1953 will be another big year for the electrical industry. Estimated production, sales and promotional activities throughout the industry bear this out.

Estimated total new construction in the United States for 1953 will be about $33.5 billion, or about 4% ahead of last year, August Eckel, middle west editor, *Electrical Construction & Maintenance*, told the group. About 70% of this will be in the private construction category. On the basis of estimated national construction, the projected market for electrical work for this year will total about $2.75 billion, or slightly over 5% gain over 1952. While electrical construction in the private and public categories will approximate last year's totals, the big gain, percentagewise will be in modernization and repair, Mr. Eckel predicted. Virtual elimination of materials controls and anticipated availability of skilled labor as present large construction projects end will make this possible. Appliance sales are expected to increase 6%; utility load growth about 7%. These combined markets will create a base market for electrical installations assured by Code safety standards. Eckel urged those present to set their sales sights to the vast optional market over and above Code standard installations. Here lies the real challenge and opportunity to sell full electrical adequacy, complete electrical convenience, and the ultimate in electrical living, he concluded.

A bright future was also predicted for the air conditioning field. For the first time in history, air conditioning sales topped $1 billion last year and an

POWER OF PERSUASION is an important part of selling technique, Dr. O. Preston Robinson, general manager, Desert News & Telegram, Salt Lake City, tells electrical industry audience at the annual conference of the Intermountain Electrical Association at Ogden, Utah.

NEW PRESIDENT of the Intermountain Electrical Association, Mark Austin (left) discusses the 1953 program with acting-manager Harry Shewell. Mr. Austin is district manager of the Sunbeam Corp. in Salt Lake City.

ENTRANCE CAPS AND FITTINGS of Rustproof Cast Aluminum Alloy by AUSTIN

No. 1572 Entrance Head. Key-hole mounting bracket for easy attachment to building.

No. 275 One Hole Strap for oval-shaped cable.

No. 2275 Two Hole Strap for oval-shaped cable.

No. SO-36 Watertight Connector. Cutaway view illustrates how 3-point compression forces rubber gland around entire circumference of cable.

No. GR-1 Grounding Ring. For bonding meter box to artificial ground. Tight connection and positive bond without soldering.

No. 6009 Non-watertight Connector. Takes a wide range of sizes and types of cable, round or oval, without the use of shims or inserts.

No. L-63 Sill Plate. Provides metallic protection to service entrance cable at the most hazardous point—where it enters the building.

3166

SOLD THROUGH ELECTRICAL WHOLESALERS

The M. B. Austin Company
NORTHBROOK, ILLINOIS

CODES, OF COURSE, were topic of this after-dinner huddle between: (L to R) William J. Hess, chief building inspector, Sacramento; Larry E. Woldit, Sacramento city electrician (inspector); and Karl Olsen, electrical inspector, Sacramento County. Scene: Sacramento Valley Chapter, NECA, annual installation dinner.

increase of $100 million is expected in 1953, Gerald Wilcox, Walter B. Lloyd Co., Salt Lake City, stated, noting that room coolers were no longer a luxury, but a necessity to the average home. Lack of appliance dealer interest, extravagant installation and service charges, and lack of 3-wire home service drops by utilities were obstacles in the past, he added. Wilcox sees the greatest market potential in the home. With less than 1% saturation today, he expects some 460,000 room coolers to be sold in 1953. At an average cost of $330 per unit, this will be a $151,800,000 market with $1.5 million in the intermountain area alone. Wilcox noted that 43 different name brand manufacturers will market room coolers this year, compared to 14 last year.

Another encouraging sign of good business ahead has been the firm orders recently placed by hard goods buyers, according to George Herrod, Herrod & Co., Salt Lake City. A sellers market on specific appliances should be cultivated, he believes. Promotion selling can spell success or failure of many businesses, he stated, but cautioned that it must be truthful and not just a means of moving distress merchandise. Customer service is important, but be fair to yourself and your customer when discussing this item. Buy carefully, for over-buying can lead to forced sales at less profits, he warned. Ken Brady, Brady-Milne Appliance Co., Midvale, reiterated this warning when he advised substituting salesmanship for cut price practices in the industry.

Charles L. Wheeler, president, Salt Lake Hardware Co., provided a highly entertaining account of the impact of the electrical industry on the domestic and business life of America, comparing the present with the past. One interesting observation he made: Retailers today are doing a miserable job of human relations.

HIGHER LIGHTING INTENSITIES ranging up to hundreds of footcandles will be the modern lighting design trend in the next 10 years, G. B. Buck, II, of G. E. Company's Lamp Division in Denver, tells the Intermountain Electrical Association conference at Ogden, Utah. Buck is demonstrating some of the lamps now available.

During a slide and demonstration discussion of modern lighting techniques, G. B. Buck, II, G. E. Lamp Division, Denver, Colorado, made these interesting predictions: industrial and commercial lighting intensities will have to be increased to hundreds of footcandles within the next 10 years; the future trend will be to 480-volt, 3-phase mercury lighting in industry; the next decade will see a tremendous expansion of germicidal lamp installations. Engineers must design lighting in accordance with human psychological requirements, he concluded.

John Longden, district representative, National Electrical Products Corp., concluded the session with the NEPCO film "Octopus In The House"—a dramatic presentation of the advantages of adequate wiring.

At the conference banquet, M. D. Schuster, general sales manager, Hoffman Radio Corporation, presented a highly informative analysis of "Tele-

vision—Yesterday, Today and Tomorrow."

New I.E.A. officers installed at the banquet included the following: president—Mark Austin, Salt Lake City, district manager, Sunbeam Corp.; vice president—Kenneth Brady, Brady-Milne Appliance Co., Midvale; secretary-treasurer—Carlos Stone, Mountain States Distributors, Inc., Salt Lake City. Representing Salt Lake City electrical contractors on the new Board of Directors are Charles I. Berrell, Jr., vice president, The Howard P. Foley Company; and E. E. Oberg, Oberg Electric Company.

California Contractors Elect '53 Slates

With the beginning of another year, California electrical contractor organizations completed their election activities and installed the following officers for 1953.

Sacramento Valley Chapter, NECA: President—W. E. Cotter, Reliable Elevator Works; vice president—Paul Benge, Benge Electric Co. Directors include: Bert Naylor, George Foss Co.; Louis Stein, Stein Electric Service; E. L. Bryant. F. R. Merwin, Merwin & Gatejen represents the group as NECA governor. William H. Welsh is chapter manager.

Northern California Chapter, NECA (Oakland): President—Vic C. Perro, El Cerrito Electric Co., El Cerrito, California; vice president—Harold Pierce, Ed Pierce Electric Co., Inc., Vallejo, California; treasurer—William A. Cyr. *Electrical West*, San Francisco (honorary member). Directors are elected by each branch of the chapter.

San Francisco Chapter, NECA (S. F. Electrical Contractors Association): President—Emil J. Weber,

W. E. COTTER, Reliable Elevator Works, Sacramento, (left) takes over as new president of the Sacramento Valley Chapter, NECA. Wishing him success is retiring president Louis Stein of Sacramento.

Take a good look at this New Powerhouse!

Designed to fit every application better . . . standby, portable, mobile and stationary. *Whatever* your need for electric power, the new Onan CW-5 and 10 give you top performance and value!

Here for the first time are 5 and 10KW electric plants powered by revolutionary, new air-cooled gasoline engines, *designed and built by Onan exclusively for electric plant use!*

Both engines are 1800 R.P.M. The 13HP Onan engine which powers the CW-5 and the 20HP Onan engine used for the CW-10 weigh much less than general-purpose engines, and are amazingly compact. Built to deliver dependable, trouble-free service in heavy-duty use. Two-cylinder, alternate-firing design assures smooth, vibration-free power. New, quiet, highly-efficient vacuum air cooling drives out all heated air through *one* side duct. The same duct carries exhaust gases, simplifying installation.

Impulse-coupled, high-tension magneto ignition for quick starting under all conditions. Both models in all standard voltages 60-cycle A.C., single or three phase.

Far Out Front in design and engineering

● Twin-cylinder, horizontally-opposed, air-cooled, alternate-firing engines ● Aluminum-alloy cylinder heads ● Extra-large, replaceable bearings ● Full-pressure lubrication, 6-quart oil capacity, oil filter ● Impulse-coupled, high-tension magneto ignition, radio suppressed ● Quiet, vacuum air-cooling of generator and engine ● Excellent accessibility; snap-off air housings ● High-performance generators ● Completely equipped with controls and instruments.

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Easiest, quickest to install!

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Strong, rustless, light weight aluminum Adalloy—preferred for weatherproof jobs

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CHECK VOLTS and AMPS WITH THE *New* COLUMBIA A.C. CLAMP TYPE VOLT-AMMETER

• Quickly • Accurately • Safely

Columbia Type AC-1 provides ampere readings with a snap by merely clamping jaws around the electrical conductor, without breaking circuit or insulation. Voltage readings are taken quickly and easily with safety plug-in leads. This instrument is the latest addition to the Columbia line of clamp type instruments of the highest quality and dependability.

TYPE AC-1 FEATURES

- Measures Up to 600 Amperes and 600 Volts.
- Amperes: 0/12/60/120/600 A.C.
- Volts: 0/150/600 A.C.
- Convenient Range Switch.
- Insulated Jaws Will Accommodate Conductors up to 1½" diameter, Bus Bars up to 2" x ½".
- Accuracy: 3% full scale.
- Light Weight — Fits Easily Into Pocket.
- High Quality At Low Cost.

PRICE $75.00 COMPLETE WITH VOLTAGE LEADS AND CARRYING CASE

Inquiries Invited From Distributors
Write for descriptive Bulletin AC-41

COLUMBIA ELECTRIC MFG. CO. 4541 Hamilton Ave Cleveland 14 Ohio

J. M. H. BAYLISS, General Manager of Bayliss & Ramey, Charleston, W. Va., cracks a few installation nuts with his chief of staff, J. W. Painter.

Weber Electric Co.; vice president—Rod Newman, H. S. Tittle Co.; secretary—E. W. Scott; treasurer—L. Roy Moser. Directors include: W. T. Kennedy, Kennedy Electric Co.; Fred E. Wider, Electrical Maintenance Co.; David I. Mahoney, Mahoney Electric Co.; E. O. Kleinhans, K-Electric of California; B. J. Doherty, B. J. Doherty Co.; C. D. Lindstrom, Weidenthal-Gosliner Electric Works. Earl Peak, Jr., Central Electric Co., Inc., represents the group as NECA governor. Wm. J. Varley is Chapter manager.

Electrical Progress Keynotes AIEE Meeting

Over 3,000 electrical engineers and scientists from many parts of the world were in attendance at the Winter General Meeting of the American Institute of Electrical Engineers, January 19-23, in the Hotel Statler, New York City. Keynote of the Meeting was electrical progress, which was revealed in 70 technical conferences and sessions on developments in electrical engineering and the allied arts and sciences.

At the opening general session on January 19, Donald A. Quarles, president of the Institute and president of Sandia Corp., Albuquerque, N. M., presented the Edison Medal to Dr. V. K. Zworykin, director of the RCA Laboratories, Princeton, N. J., and pioneer researcher in electronics. The keynote speaker at this session was Henry Townley Heald, chancellor of New York University and former president of the Illinois Institute of Technology, who chose "Education and Public Policy" as his topic. Awards for technical papers in the Communications, General Applications, Power and Science and Electronics Divisions were presented at the session.

In the technical sessions and con-

ferences, a wide range of subjects were covered, including industrial power systems, electric space heating and heat pumps, maintenance of rotating machinery, relay applications, power supply for resistance welding machines, metallic rectifiers, elevators and escalators, industrial grounding, hazards in hospitals, magnetic amplifiers, instruments and developments in the power generating and electronics industries. Many sessions were devoted to discussions of topics of interest to the electrical construction and maintenance industry.

Equipment Grounding

At one of the opening sessions of the five day conclave, L. G. Carpenter, an electrical engineer of the General Electric Company, discussed the importance of proper equipment grounding, which he described as "connecting to ground of non-current carrying metal parts of the wiring system or apparatus connected to the system." He referred to adequate equipment grounding as "one of the most important factors in safety to personnel in industrial plants." It was reported that 117 injuries, including one death, had resulted from contact with ungrounded equipment in California in 1951.

"The object of equipment grounding", Mr. Carpenter said, "is to limit the potential between separated non-current carrying parts, and between these parts and earth, to a safe value under all conditions of normal or abnormal operation. . . . An equipment grounding system should consist of a firm interconnecting bond between

JOHN SOFIA, job superintendent for electrical contractor Ed May of Albany, N. Y., practically lived in the State Capitol Building during the period when 60-year-old switchgear was replaced with modern equipment and new feeders were installed without interruption of service.

The NEW Crown Internal Growler energizes suspected coils—while a self-contained sensitive meter and pick-up simultaneously check the *same* coil area that is excited. This exclusive feature enables you to pin-point shorts—to eliminate the guesswork and wasted time with hacksaw blades or vibrating reed type testers. You can easily find shorts that give too weak an indication to be found by other means. Once around the stator, armature or rotor gives a complete check—even in the hands of an inexperienced operator.

There's no chance for error. A definite movement of the meter needle indicates shorts. **ORDER NOW—USE THIS COUPON—**

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Please send_____CROWN Internal Growlers at $37.30 each, F.O.B. Woodstock, Ill.

☐ CHECK ENCLOSED. Amount $_____

☐ Send on our P.O. Number _____

☐ Send only FREE Illustrated Catalog Sheets now.

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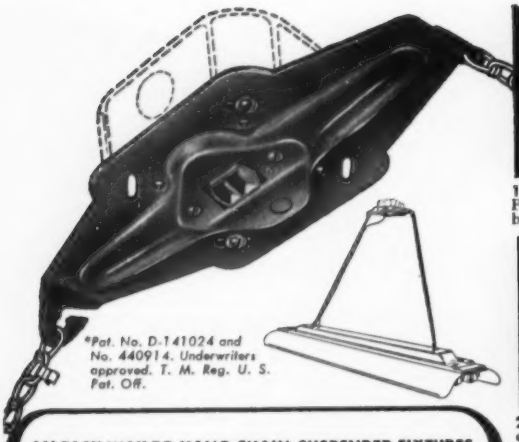

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AN EASY WAY TO HANG CHAIN-SUSPENDED FIXTURES
IN LESS TIME...AT LESS COST...WITH LESS WORK
WITH

HYDEE HANGER*

"DECIDEDLY BETTER"
DAY-BRITE
Lighting Fixtures

01

1. Connect wires to receptacle. Fits standard 4" or 3¼" outlet box or plaster ring.

2. Screw hanger to outlet box—only two screws needed. No centering, punching, or drilling. Screwdriver only tool needed.

3. Hang the fixture and plug it in. That's all! Self-grounding—regular 2-wire cord and plug may be used.

Hydee Hanger: complete with receptacle, two 5-ft. chains, "S" hooks and clips—

Day-Brite Lighting, Inc., 5402 Bulwer Ave., St. Louis 7, Mo.
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If you repair
ELECTRICAL
EQUIPMENT
You must be worrying about rising labor costs.
See the "EQUIPMENT SECTION" of our new catalogue for a full line of tools expressly designed to save you time and money. You'll find everything you need from commutator saws to baking ovens to help do the job better and faster.
For the best and latest in TOOLS AND EQUIPMENT you can depend on
"Your Best Source of Supply"
COMPLETE READING ELECTRIC CO., INC.
JEFFERSON AND MONROE ST., CHICAGO 6, ILLINOIS

equipment frames and enclosures, conduit and other non-current carrying parts, with solid connections to ground." It was particularly noted that small apparatus and portable low voltage devices should be provided with an equipment ground to eliminate their potential hazard.

Electrical Maintenance

Maintenance of rotating machinery was discussed at a meeting presided over by chairman Walter J. Prise, The Maintenance Company, New York. Carl E. Boesmiller, Dept. of Water & Power, Los Angeles, spoke on the troubles experienced by a large utility in the commutation of large rotating machinery. G. L. Moses, Westinghouse, chairman of the Working Group of the Insulation Subcommittee, outlined factors affecting the life of insulation and recommended tests for use in the maintenance of insulation. An outline of procedures and methods used by independent motor repair shops and members of the National Industrial Service Association was given by Samuel Heller, Consolidated Electric Motor Co., New York. The problems and methods of maintenance of rotating electric equipment on shipboard were discussed by W. H. Fifer, Bureau of Ships.

460-volt Lighting

In another technical paper, W. H. Kahler, Westinghouse Electric Corp., Cleveland, Ohio, and R. N. Bell, E. I. du Pont de Nemours & Co., Wilmington, Delaware, discussed the economic advantages of using higher voltages for industrial lighting systems. Comparing the economic advantages of separate systems for lighting and power and combined systems, they said their study indicated "that the investment in the distribution system for supplying lighting loads can be considerably reduced by installing a combined power and lighting arrangement in which the lights are supplied directly from the 460-volt supply." They pointed out that high voltage lighting offers lower cost and substantial copper savings.

Hazards in Hospitals

In an hour-long demonstration, Paul G. Guest, electrical engineer of the United States Bureau of Mines, discussed the sources of static electricity in hospital operating rooms and the methods of preventing explosions. Mr. Guest used more than 200 pounds of specially designed laboratory apparatus to show that static creates serious hazards in operating rooms. This equipment included: a miniature operating table, samples of rubberized fabric (conductive and non-conductive), synthetic fabrics, several types of explosion vessels, an "electric

chair", several static machines and many sensitive detecting instruments.

Magnetic Amplifiers

Improvement in magnetic materials and metallic amplifiers has resulted in wide use of the magnetic amplifier for measurement and control of direct current in industrial, mining and railway applications, it was reported by W. A. Derr and E. J. Cham, Westinghouse Electric Corp., East Pittsburgh, Pa. Recent developments with magnetic materials now make it possible to provide complete isolation and adequate insulation from high dc voltages for instrumentation, protection and control circuits. Previously, special precautions had to be taken at dc conversion stations on switchboards to protect operating personnel and prevent insulation breakdown.

Submarine Cable

About 20 miles of a new light weight, unarmored submarine cable, weighing a fraction of the steel clad type in use for many years, was successfully laid in an experimental test by Western Union Telegraph Co. The report on the new cable was made by C. S. Lawton and L. H. Hutchins, Jr., of Western Union and Simplex Wire & Cable respectively. The new cable was designed to lie in soft silt where it is not subject to abrasive action, and to withstand the stress and strain of being raised and lowered, without requiring steel jacketing. The new cable uses 10 strand cadmium bronze wire, covered with polyethene, a comparatively new dielectric.

Low-Voltage Switchgear

A new line of switchgear, said to be the first new and completely coordinated breaker and equipment design covering all ratings, was described by

ELECTRICAL CONTRACTOR I. J. Reed (left), Reed Electric Co., Murray, Utah, discusses adequate wiring with J. F. McAllister, director of residential and farm sales, Utah Power & Light Co., Salt Lake City, during recess at recent conference of the Intermountain Electrical Association at Ogden, Utah.

Install SAFE* ALL-ELECTRIC ELECTROMODE HEAT

HARD-TO-HEAT AREAS
FACTORIES
OFFICES
ISOLATED BUILDINGS
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HUNDREDS OF OTHER LOCATIONS

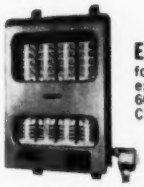
Regardless of how your plant is heated, Electromode all-electric Unit Heaters will solve those persistently hard-to-heat areas. Easily installed wherever electric current is available. Require no piping, flues or fuel storage. You can order, install and heat within one day. Available from 1500 to 45,000 watts, in portable, suspension and wall models.

***SAFE** Only Electromode has the completely sealed-in, cast-aluminum heating element. No danger of fire, shock or burn. Built-in safety switch prevents overheating.

ECONOMICAL All current entering the unit is converted into heat. There is no heat loss en route, like there is with long steam pipe runs. This system cannot freeze. The heating element will not rust, corrode or deteriorate. For utmost economy, can be thermostatically controlled.

COMBINATION PORTABLE and SUSPENSION type models, 1500 to 7500 watts (5,122 to 25,613 btu). Adjustable louvers permit directing heat into working zone. Model AN-30A illustrated.

SUSPENSION TYPE MODELS available from 10,000 to 45,000 watts (34,150 to 153,675 btu). Adjustable louvers permit directing heat into working zone. Model 14-10 illustrated.



EXPLOSION-PROOF HEATERS for heating hazardous areas subject to explosion. In three sizes: 2000, 4000, 6000 watts (6830 to 20490 btu). Model CX-2 illustrated.

AUTOMATIC WALL-TYPE HEATER with Down-Flo principle distributes clean, healthful, fan-circulated heat at floor level. Available from 1500 to 4000 watts. Model WA illustrated.

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BELLS · BUZZERS · HORNS · CHIMES · VISUAL AND AUDIBLE PAGING DEVICES AND SYSTEMS

SUPERVISION of electrical construction activities is one of the many responsibilities of Walter Smithen, vice president, T. L. Rosenberg Co., Oakland, California, electrical contracting firm. He is also active in labor relations and association work.

F. W. Lewis, General Electric Co., Philadelphia, in a technical paper. The new drawout equipment includes both indoor and outdoor designs, rated 600 volts ac and 250 volts dc, in continuous current capacities from 15 to 4000 amperes and in interrupting and short time current ratings from 15,000 to 100,000 amperes, to meet industry standards. Standard components are used in this switchgear allowing an unlimited number of standard combinations to be built. Wiring facilities built into the supporting framework segregate the secondary wiring from the primary compartment. Other features of its construction are also new.

Following a report of the Institute Nominating Committee, Elgin B. Robertson, president of Elgin B. Robertson, Inc., Dallas, Texas, was nominated for the presidency of the American Institute of Electrical Engineers. Results of the balloting will be announced at the Summer General Meeting, June 15-19, 1953.

NISA News

Regular dinner meeting of the New York Metropolitan Chapter took place in the Skyline Room of the Hotel Shelburne, New York on January 15. Alex Shovan presided. All committee chairmen made their reports which included reports on preparation for 1953—20th Anniversary Convention.

After dinner, Herbert Engleman, chairman of Program Committee, introduced Victor Leibman and D. Stein of the Columbia Technical Corpora-

tion, who spoke on Electronic Winding Testers which can be adopted to many jobs in the repair shop.

• • • •

Paul Richards, service manager of Electro Dynamic Company, who is well known to many of our NISA members, will talk at the NISA 20th Anniversary Convention on the subject of "Reduction of Noise and Vibration in Electric Motors."

Mr. Richards has been associated with the Electro Dynamic firm since 1927. He served long with the U. S. Navy as an Electrician aboard Submarines, where noise and vibration control are a most critical safety factor.

Mrs. A. Bonahur has asked to be relieved of the Co-Chairmanship of the Ladies' Committee for the coming Convention. Her place will be taken by Mrs. Edward Everts.

Making Small Transformer Winding Profitable, is the subject of an illustrated talk to be given by R. E. Ward, Sr., at 20th Anniversary, New York NISA, May 24-28, 1953 Convention. Bob Ward is a past President of NISA and since 1929, has served as directing head of the Electric Motor Repair Company, Raleigh, North Carolina. In the past few years the Electric Motor Repair Company has developed a modern shop especially designed to efficiently handle a large volume of varied transformer rewinding jobs. Al Clot has shown a lot of worthwhile ideas in the past and we may looked forward with great interest to seeing his improved balancing tool in operation, as devised especially for

NEW MANAGER of apparatus sales and repair for T. L. Rosenberg Co., Oakland, California, is Ken Moyle who was formerly an application engineer for Sterling Electric Motor Co. in San Francisco. Overall supervision of the motor repair shop is part of Moyle's new responsibilities.

P & R End Bell Bearing REAMER

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LET THE EXPERIENCE OF PROGRESSIVE PROFIT-WISE SHOP OWNERS GUIDE YOU!

"We get the ultimate in precision bearing fittings with a P & R Reamer. Bearings are reamed at true right angles with the critical surface of the end bell and will not allow any misalignment when the motor is assembled."

SAYS ED GRANT
Tennessee Electric Motor Service
Nashville, Tennessee

Sure precision work and so much faster and easier than outdated hand or alignment reaming methods. Profit-wise shop operators are cutting costs with the P & R End Bell Reamer. It will earn extra profit for you—eliminates reaming headaches!

- NO SKILLED OPERATOR NEEDED
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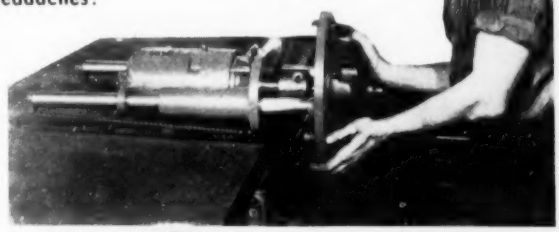
- YEARS OF SERVICE



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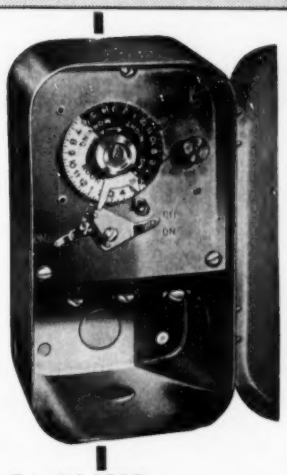

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Type 401 S.P.S.T.
20 Amps.—125 Volts

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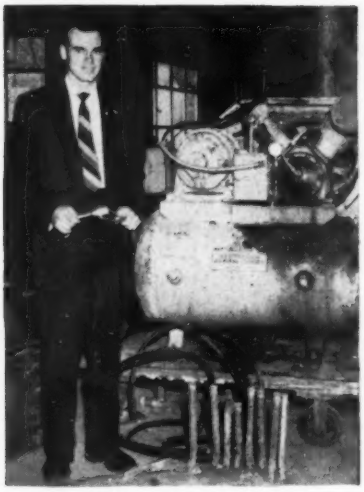


A PROPONENT of adequate job tools, J. Conrad Abbett, vice president, Abbett Electric Corp., San Francisco, finds this motor-driven air compressor a very handy piece of equipment on a hospital project.

Motor Repair shop application. He will talk on the subject of "Dynamic Balancing" at the convention. Mr. Clot is head of the Peninsular Armature Works, Miami, Florida, and has served as President of the Southeastern Chapter NISA.

• • • •

Arthur Wagner Co., Chicago, has purchased the building next to its present five-story structure, adding approximately 8,000 sq. ft. to its operation. The new acquisition will house the company's repair shop, including two new 5-ton electrically-operated traveling cranes enabling the firm to handle larger equipment.

• • • •

The fourth quarterly meeting of the Mid-South Chapter was held in Memphis December 6. In the morning the group toured the Memphis Firestone plant, then had lunch at the Peabody Hotel. A business meeting followed. New officers of the chapter include: Thomas M. Russell, Russell Works, Memphis, vice president; Murphy G. Miller Sr., secretary-treasurer; Electric Motor Service, Birmingham, directors. Next meeting is scheduled for Nashville, March 14.

• • • •

The first foremen's meeting of the Ontario Chapter was held December 13 at the Hotel London, London, Ont. Thirty-two members and guests from 15 shops heard from an official of the Canadian Apprenticeship Training Dept., and appointed a committee to investigate the possibility of making an apprentice training program available to chapter members. Frank Pater-

son, Ainsworth Electric Co., Toronto, spoke on transformers and the problems encountered by the average repair shop.

• • • •

The Niagara Chapter held its regular monthly meeting, December 12, at the Forty & Eight Club in Buffalo. Hugh Maxwell, ITE Circuit Breaker Co., Philadelphia, spoke on circuit breaker operation and construction. His talk was followed by a general discussion of the application of circuit breakers, especially to motor circuits, and a comparison of circuit breakers, fuses and fusetrons. The relative advantages of the two types of protective devices were pointed-up.

• • • •

The San Diego Chapter held its annual Christmas Party December 15 at Langhorts's Restaurant. It was "Ladies' Night", and the chapter reported 100% attendance. A brief business meeting was followed by entertainment, including travel and special events films furnished by Standard Oil Co.

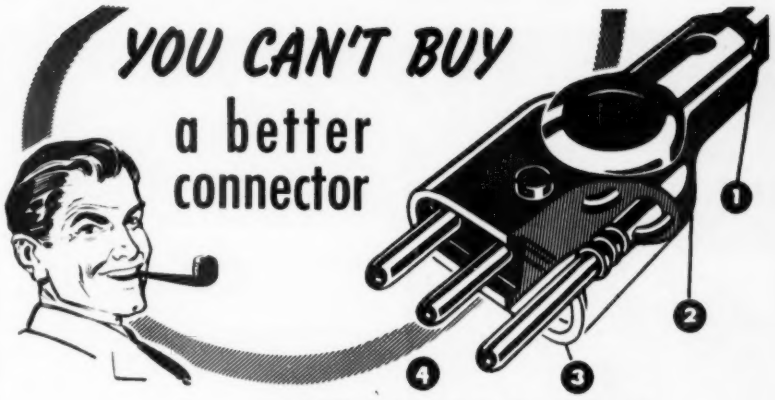
• • • •

George Waldo, Waldo's Electric Shop, Sycamore, Ill., died in December. He was a member of the Central District Chapter, NISA, Chicago, for many years. He is survived by his widow and two sons.

• • • •

R. B. Mears, Mears Electric Co., Wichita, Kans., has sold his interest in his company to his partner, George Moore. The firm name will remain. "After 47 years in electrical work, 40 of which I have been in business for

GUILFORD S. PROLICH, new manager, Utah-Idaho Chapter, NECA, Salt Lake City, sees a tremendous electrical modernization potential in the Salt Lake area. Prior to coming to Salt Lake City this January, he was assistant executive-secretary of the Heating, Piping and Air Conditioning Contractors Association of Northern California.



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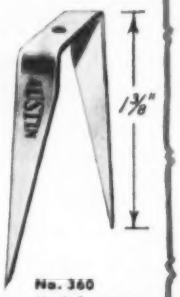
No spreading or buckling with Austin staples! Made of heavy, selected temper, round edge flat wire with sharp, burr-free points.

Flat across top — no spreading or buckling.

The shoulders are square and strong—drives easily and accurately.

Long taper to point — staple held firmly at the first tap of hammer.



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Made for armored cable. Available without indenture in top for non-metallic sheathed cable —Cat. No. 361

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Designed specifically for non-metallic sheathed cable. Made shorter for easier driving.

Stamped of heavy, selected temper, round edge flat wire.

Sharp, burr-free points—staple starts easily in any wood.

No. 363
The new staple is specially designed for small diameter non-metallic sheathed cable. Small in size—easier to drive.

Austin staples are conveniently packed in sturdily made, metal edge cartons of 100 and 500, and in cases of 2500.

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myself," Mears states, "I feel entitled to retirement."

• • • •

Lockwood Electric Motor Service Inc., Trenton, New Jersey, held a very successful open house on December 20. This annual affair was attended both by customers and friends. Humorous and cheerful George Lockwood, owner of the place, proudly presented to his guests the new addition to his shop—High bay motor assembly area built by George and associates themselves.

From Walter J. Prise, The Maintenance Co., New York, N. Y.

Lighting Maintenance Association Formed

Associated Lighting Maintenance Companies of America is the name of a new electrical industry trade group formed on January 23rd at Nela Park, Cleveland, Ohio.

Formal organization of the group climaxed a two-day conference attended by representatives of 30 lighting maintenance companies from all parts of the United States. Conferees agreed that lighting maintenance—as a business—has grown to the point where it can and should be operated as a separate division of an electrical construction enterprise; that past experience has proved that such a service can be offered on an economical basis to commercial and industrial customers.

Prime goal of the new organization, acording to chairman Bert Osterman, head of the lighting maintenance division of T. L. Rosenberg, Co., Oakland, California, electrical contractors, is to exchange ideas on department organization, service techniques, equipment requirements and maintenance schedules. The 30 companies represented at the conference became

ALMCA CHAIRMAN Bert Osterman is manager of the lighting maintenance division of T. L. Rosenberg Co., Oakland, California.

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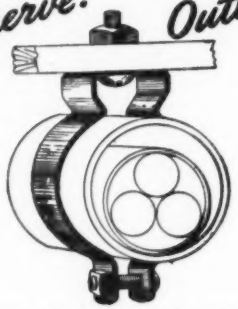

Minerallac Cable, Conduit and Messenger Hangers are STEEL. Easier, quicker to install; permit speedy, compact wiring; economical. Also in Everdur . . . Porcelain insulating Bushings available.

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Jiffy STEEL Clips (Pipe-clamp) require only one screw, nail or bolt; rib-strengthened; for hanging pipe, conduit, BX cable, mounting coils, etc. Millions in use.

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Steel Straps for Messenger-cable services on outlet boxes; may be used in conjunction with hangers.

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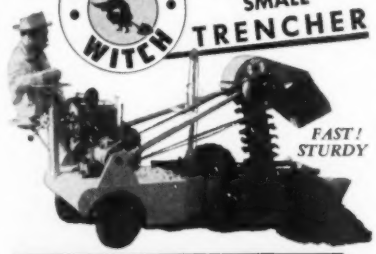
World's Best SMALL TRENCHER



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Digs 2" to 6" Trenches
Any Depth to 36"

A self-contained ditcher operating under its own power—digs clean even 2" to 6" trenches to a 36" depth. Light weight, mobile, low operating and maintenance costs.

DITCH-WITCH *used in these Industries*
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DITCH-WITCH digs as many feet of trench as machines four times its size. Pays for itself in a few days.

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charter members of ALMCA. Organization by-laws are being formed.

Assisting chairman Osterman in guiding the course of the new group are: vice chairman—Kenneth L. Purington, Lighting Sales and Service Co., Davenport, Iowa; and secretary-treasurer—Edward Creed, Lighting Maintenance Co., Cleveland, Ohio.

Two Electrical Men Honored

Two representatives from the electrical industry were honored on February 16 when they received awards as employees of the U. S. Department of Commerce "for outstanding contribution to the public service, the nation, or humanity". They were William H. Kennedy and Carney G. Laslie, Jr., both with the Electrical Equipment Division, National Production Authority, Washington, D. C., an agency under the Department of Commerce. Secretary of Commerce Sinclair Weeks made the awards.

A gold medal, the Department of Commerce's highest award for exceptional service, was awarded to William H. Kennedy. With it went this citation: "For outstanding contributions to the program of the National Production Authority in the development of the basic format used for the mobilization fact book, an invaluable foundation for past and future mobilization planning".

Mr. Kennedy joined the Electrical Equipment Division of NPA in November of 1951, as chief of the Lighting Fixtures and Interior Distribution Branch. Previously he was with Bussmann Mfg. Co., St. Louis, Mo., Division of McGraw Electric Company for 20 years, and Franklin Electric Co., Philadelphia wholesalers.

A silver medal was awarded to Carney G. Laslie, Jr., for meritorious service, with this citation: "For outstanding contributions to the program of the National Production Authority, with particular reference to the instigation and installation of the initial Mobilization Base Books which were a very important part of NPA planning for full mobilization".

Mr. Laslie is Deputy Director of the Electrical Equipment Division, NPA, and chief of the Program and Requirements Branch. Before coming to NPA, he was director of the Commerce and Industry Dept., Civilian Administration of the Ryukyu Islands (1950-1951); and with the electrical equipment unit, Economic and Scientific Section, Supreme Commander Allied Powers (1947-1950). Mr. Laslie was with the Electrical Products Section of the WPB in Washington, from 1941 to 1946.

Carry WATER, GAS AIR LINES, CABLE *at any angle to beams*

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On open steel construction, Efficiency "Type F" Conduit Hangers are your best choice for carrying ½" to 2½" pipe and armored cable. Patented radiating ridges and 5-point gripping surface keep pipe and cables suspended dead center, permitting it to be carried securely at any angle to the beam. Write today for Catalog 38-A.

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EAST PALESTINE, OHIO

"EFFICIENCY" DEVICES FOR CONDUIT and CABLE SUSPENSION

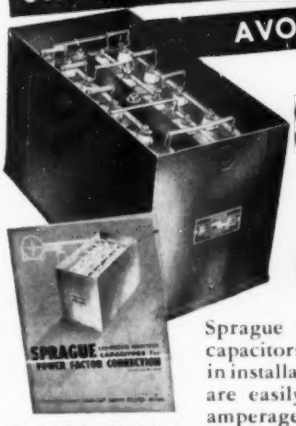
REDUCE POWER BILLS!

CUT WIRING, TRANSFORMER AND SWITCHGEAR COSTS *in new installations*

AVOID REWIRING

with

SPRAGUE "ON-THE-SPOT" *Power Factor* CAPACITORS



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28 pages replete with PFC money-saving suggestions and installation data. Ask for guide 508

Sprague power factor correction capacitors can save you real money in installations, large or small! They are easily connected, reduce line amperage and thus go far toward reducing costs. Your circuits will handle considerably more load if Sprague Capacitors are installed at your motor terminals—and no separate fused switches are required!

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Please send me the free Sprague catalog "Power Factor Correction" (333)

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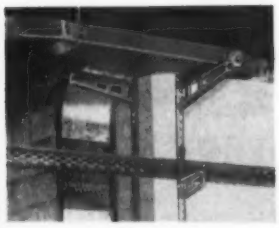
ONE-PIECE
RAKIT®

Rakit, the easiest-to-assemble system of supporting structures ever devised, now offers a revolutionary one-piece bracket. This features even greater simplicity of installation by the twist-of-the-wrist method with more assembly time saved. No bolts, nuts or other fasteners are required.

The many savings in assembly time and labor afforded by the new one-piece Rakit assures "greater support at less cost." Write today for complete details.



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CHECKING PLANS on a joint venture electrical installation at Mare Island Navy Base are Alex Fulton (left), electrical engineer for George F. Brayer Electric Co., San Francisco; and Carl C. Severin, owner, Severin Electric Co. in the same city.

Book Reviews

Electrical Drafting And Design

A full treatment on making drawings to convey to the contractor a clear picture for carrying out electrical installations is presented in the book "Electrical Drafting and Design" by Calvin C. Bishop. This book was written to fill the need for an authoritative text which establishes the basic principles and methods of illustrating electrical equipment, components, circuits and systems, and guides the draftsman.

The book covers 267 pages, broken down into nine chapters which include: general instructions for mechanical and electrical drafting, circuit diagrams, switchboards, outdoor substations, wiring layouts, residential wiring, lighting and industrial plants. Supplementing the text are many diagrams, sketches and photographs, ninety tables of pertinent electrical data and specifications and National Electrical Code regulations, and ten charts of graphical symbols and graphed data for various computations.

In handling the topic of each chapter, a discussion is given first and then a typical example is analyzed. The principal related rules from the 1951 National Electrical Code are then given, with the corresponding section number from the code. In many cases, practical hints from the author's experience are also included. Following the discussion and example, a typical problem is presented for solution. Available for use in conjunction with the book is a set of problem sheets on electrical drafting.

The book is published by the McGraw-Hill Book Company, 330 West 42nd St., N. Y. 36. It lists for $4.50.

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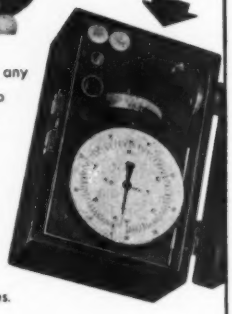

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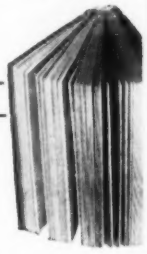

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Electrical Industry Convention—Nicollet Hotel, Minneapolis, Minn., March 8-11.

National Electrical Manufacturers Assn.—Edgewater Beach Hotel, Chicago, Ill., March 9-12.

Industrial Electrical Exposition—Sponsored by Essex Electrical League, Terrace Room, Newark, N. J., March 10-13.

Electrical Maintenance Conference—Sponsored by the Electrical Maintenance Engineers Association of Southern California, Rodger Young Auditorium, Los Angeles, Calif., March 18-20.

Edison Electric Institute — Annual sales conference, Edgewater Beach Hotel, Chicago, Ill., March 30-April 2.

Chamber of Commerce—Annual meeting, Washington, D. C., April 26-29.

Industrial Trade Show—Sponsored by the Electric Association of Kansas City, Exhibition Hall, KMBC Building, Kansas City, Mo., April 28-30.

Chicago Electrical Industry Show — Sponsored by the Electric Association and the Electrical Maintenance Engineers of Chicago, Conrad Hilton Hotel, Chicago, May 11-14.

National Fire Protection Association—Annual meeting, Palmer House, Chicago, Ill., May 18-22.

National Industrial Service Association—Annual convention, Hotel Statler, New York City, May 24-28.

National Association of Electrical Distributors—45th annual convention, Conrad Hilton Hotel, Chicago, Ill., May 24-28.

Edison Electric Institute—21st annual convention, Atlantic City, N. J., June 1-4.

American Institute of Electrical Engineers—Summer general meeting, Atlantic City, N. J., June 29-July 3.

N. Y. State Electrical Contractors and Dealers, Inc. — Annual convention, Saranac Inn, Saranac Inn, N. Y., June 29-July 3.

Illuminating Engineering Society—Hotel Commodore, New York, N. Y., September 14-18.

International Association of Electrical Inspectors—25th Jubilee meeting, Edgewater Beach Hotel, Chicago, Ill., September 21-26.

National Electronics Conference—9th Annual conference, Hotel Sherman, Chicago, Ill., September 28-30.

Industrial Electric Exposition—Hotel William Penn, Pittsburgh, Pa., October 6-8.

Canadian Electrical Manufacturers Assn.—Annual meeting, General Brock Hotel, Niagara Falls, Ontario, Canada, September 23-25.

National Electrical Manufacturers Assn.—Haddon Hall Hotel, Atlantic City, N. J., November 9-12.

National Electrical Contractors Association—Annual convention, Miami Beach, Florida, November 17-20.

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Among the Manufacturers

Headquarters Announcements

The Miller Company, Meriden, Conn.—L. Melvin Grawemeyer, vice president in charge of sales, Illuminating Division.

Harvey Hubbell, Inc., Bridgeport, Conn.—J. C. Hicks, vice president.

American Metal Hose Branch, American Brass Co., Waterbury, Conn.—Alexander B. Freeman, vice president.

Irvington Varnish and Insulator Company, Irvington, N. J.—Gordon C. Brown, vice president and general manager of the Fibron Division; Bernard M. Hoey, sales manager of the Fibron Division.

Furnas Electric Company, Batavia, Ill.—Walter A. Meyer, general sales manager.

Allis-Chalmers, Milwaukee, Wis.—Earl G. Krahn, John F. Sellers, Jr., and Claude J. Krenzer, engineers in the power department.

BullDog Electric Products Company, Detroit, Mich.—Kent P. Stiner, product engineering coordinator.

General Electric Company, Schenectady, N. Y.—Walker H. Henry, manager of marketing department, Motor and Generator Division; Olaf F. Vea, general manager Medium Induction Motor Department; Oscar L. Dunn, manager Direct Current Motor and Generator Planning Study; Fred B. Hornby, general manager Synchronous and Specialty Motor and Generator Department.

Westinghouse Electric Corp., Pittsburgh, Pa.—E. V. Huggins, vice president of corporate affairs; Joseph E. Baudino, vice president in charge of all operations.

General Electric Company, Bridgeport, Conn.—Raymond B. Elmendorf, marketing manager Construction Materials Conduit Products Department.

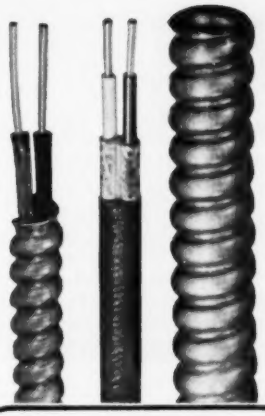
Thomas & Betts Company, Elizabeth, N. J.—George B. Edwards, head of sales service group; Arthur G. Mason, head of commercial group.

Electro Dynamic Div., General Dynamics Corp., Bayonne, N. J.—Dean W. Paul, sales manager.

American Electrical Heater Company, Detroit, Mich.—Richard G. Ellis, general sales manager.

Rockbestos Products Corp., New Haven, Conn.—Richard H. Bamford, assistant sales manager.

Minneapolis-Honeywell Regulator Company, Philadelphia, Pa.—O. B. Wilson, industrial instruments sales manager for the Industrial Division.



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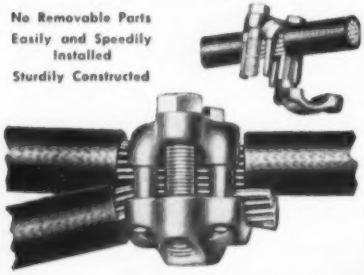

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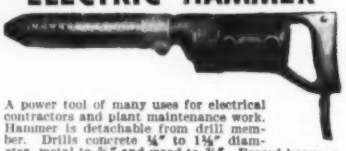

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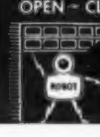

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The Century Electric Company: Gunnar Moe, assistant district manager of the New York City office.

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General Electric Company: T. J. Marshall, Chicago, representative for the Construction Materials Dept.; K. W. McDonald, Cleveland, representative for the Construction Materials Dept.

General Controls Company: Donald P. Shafer, manager of the Columbus, Ohio, branch office.

Anaconda Wire & Cable Co.: James P. Ruch, Detroit, Mich., office.

WEST CENTRAL

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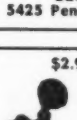
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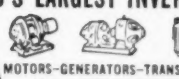
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875 ft.	Okonite	10/Pr. #19	Okonite Okoprene Twisted in Prs.
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- ✓ Modern styling
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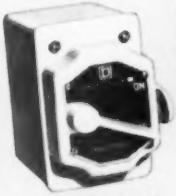
- ✓ Dependable melting alloy type overload protection—trip-free
- ✓ Definite trip indication
- ✓ Interchangeable overload relay units accessible from the front
- ✓ Open type starter can be used with standard switch box and flushplate

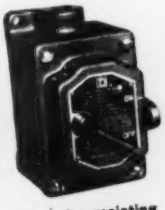
a Variety of Enclosures

General purpose enclosure—with or without pilot light



Water-tight and **dust-tight** enclosure

Water-tight and **dust-tight** with pilot light



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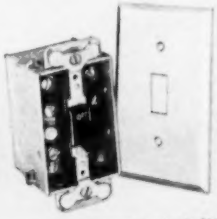

Flush mounting. Basic starter mechanism can be used with standard switchbox and flush plate — or with flush plate only for machine tool cavity mounting.

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Single pole
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"Any electrical contractor can make a competitive bid on an installation of G-E remote-control wiring," says Domenic Faraone of Thomas Electric, Cranston, Rhode Island. "We did the Pilgrim Park houses in Warwick for a figure slightly in excess of that for conventional wiring," added Mr. Faraone. "These houses sell for $13,000 to $20,000.

"At first glance it looks like a remote-control system takes a lot of wiring," Mr. Faraone said. "But most of it is lightweight, 24-volt, control wire. You staple it to the studding and it goes in fast. It took a day or so for the men to realize that the installation is actually simple. But it wasn't long before they were making good time. As the men gain experience, the cost spread becomes very small between remote control and conventional wiring.

"Since G-E remote control stirs up business for builders," Mr. Faraone continued, "I am going to recommend it wherever I can."

Rhode Island Houses Sell Like "Hot Cakes" with G-E Remote-Control Wiring

"It's hard to hold down my enthusiasm for G-E remote-control wiring," says Rhode Island builder Romeo S. Picerne of Kelly & Picerne, Inc. "We featured remote control in only one advertisement for our Pilgrim Park homes. The response from the buying public was immediate and the resulting orders very gratifying.

"G-E remote control costs slightly more than conventional wiring," Mr. Picerne said, "but I don't know where you can find a comparable sales feature at this low cost."

Adds Convenience and Safety

G-E remote control is a modern wiring system, using low-voltage switching, that permits you to have as many ON-OFF controls of any light or outlet as you wish . . . including master switches each of which will turn ON or OFF nine lights or outlets from one location. It adds convenience and safety . . . is economical for residential or commercial buildings.

Contractors Manual

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